The Biofuels Databook
2012-2013

including the official Selector voting instructions for

The 50 Hottest Companies in Bioenergy
and
The 30 Hottest Companies in Renewable Chemicals and Biobased Materials

Including company profiles, the Advanced Biofuels Project Database, the Top 100 People in Biofuels, the 50 Hottest Companies 2008-2012 and more.
The 2012-13 50 Hottest Companies in Bioenergy

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WELCOME!

Dear Selector,

First of all, thank you for being a selector for this year’s 50 Hottest Companies in Bioenergy. In this effort, you are joining more than 100 scientists, industry leaders, and journalists in a dozen countries, plus the readers of Biofuels Digest.

Holding this behemoth, you may be wondering what you got yourself into!

The information contained in this volume is not required reading. Rather, these company profiles, recommendations, and other materials, are here to assist you. You can use them, or not, as you see fit.

The companies themselves supplied a lot of the material in this book — I made an effort to edit out the “promotional material” and strike anything outrageous. If I missed something you think looks goofy, just skip by it.

Hottest does not mean “best”, “biggest” or “most significant” – it means, in your judgment, the companies that best combine the qualities of visibility and credibility, and have the most reasonable potential to reach oil parity pricing and scale.

I hope you find the process enjoyable and educational throughout this month as you deliberate, and this Data Book will be of value to you throughout the year ahead.

With regards,

Jim Lane
Editor & Publisher
Biofuels Digest

September, 2012
Key Biscayne, FL
INSTRUX

1. With this Databook, if you have received a Hot 50 ballot in .doc format. Please return your ballot by email to jlane@biofuelsdigest.com, no later than 5pm ET, October 17, 2012.

3. You do not have to choose a complete Hot 50 – just as many as you wish.

4. You may select from any companies actively formed and in the bioenergy sector as of October 1, 2012 – whether or not that company appears somewhere in this selector book or not.

5. Please make your selections in rank order – the Hotest Company at #1, and thence down to #50 or wherever you decide to stop. Your #1 choice will receive 50 points, #2 will receive 49...and so on until 1 point is given to your #50 choice.

7. You are allowed to vote for your own company, if you work for one that is eligible – or for a company you have evaluated, consulted for, or invested in.

8. Please do not reveal your choices until the Hot 50 is officially announced on October 29, 2012 at 5pm ET.

9. Please note that if a company is missing from the selector book, that simply means that their staff did not submit a profile in time.

Thank you for your participation!
### HOT FUELS, FEEDSTOCKS AND TECHNOLOGIES

#### What are the “hottest” biofuels? Please rank in order.

<table>
<thead>
<tr>
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<td>Biobutanol</td>
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<td>Biohydrogen</td>
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<td>Furfural</td>
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<td></td>
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<td>3.4</td>
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<tr>
<td>Drop-in, renewable gasoline (“green gasoline”)</td>
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<td></td>
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<tr>
<td>Drop-in, renewable diesel (“green diesel”)</td>
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<tr>
<td>Drop-in, renewable jet fuel</td>
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*The Rating Score is the weighted average calculated by dividing the sum of all weighted ratings by the number of total responses.

#### What are the “hottest” feedstocks. Please rank in order.

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<th>Ranking Score*</th>
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<td>Corn</td>
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<td></td>
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</tr>
<tr>
<td>Soybeans</td>
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<tr>
<td>Sugarcane, energy cane</td>
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<td></td>
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<tr>
<td>Jatropha</td>
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<td>Algae</td>
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<td></td>
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<td>163</td>
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<tr>
<td>Forest woods (e.g. woodchips, poplar)</td>
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<td>Other food-based ethanol feedstocks (e.g. sugar beets, cassava)</td>
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<tr>
<td>Other food-based biodiesel feedstocks (e.g. castor, palm)</td>
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<td></td>
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<td>Energy grasses (miscanthus, switchgrass)</td>
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<td>163</td>
<td>6.7</td>
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<tr>
<td>Waste biomass (e.g. agriculture, animal, municipal or forest residues)</td>
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<td>163</td>
<td>7.5</td>
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*The Rating Score is the weighted average calculated by dividing the sum of all weighted ratings by the number of total responses.
**What are the “hottest” processing technologies?**

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<th>9</th>
<th>Number of Responses</th>
<th>Ranking Score*</th>
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<tr>
<td>Ethanol fermentation</td>
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<tr>
<td>Biodiesel (transesterification)</td>
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<td></td>
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<td></td>
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<td>4.8</td>
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<tr>
<td>Cellulosic ethanol - acid or enzymatic hydrolysis</td>
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<td>5.8</td>
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<tr>
<td>Hydrotreating - converting bio-based oils to renewable diesel, gas or jet fuel</td>
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<td>162</td>
<td>5.1</td>
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<tr>
<td>Fisher-Tropsch process - biomass-&gt;syngas-&gt;fuel</td>
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<td>Gasification (other than F-T) - drop-in fuels, ethanol from biomass</td>
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<td>162</td>
<td>6.0</td>
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<tr>
<td>Pyrolysis - biocrude, biooil, biochar</td>
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<td>162</td>
<td>5.8</td>
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<tr>
<td>Anaerobic digestion - methane from biomass</td>
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<td>162</td>
<td>5.1</td>
</tr>
<tr>
<td>Solar Fuels - microbial conversion to drop-in hydrocarbons using CO2, water, sunlight</td>
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<td></td>
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<td>162</td>
<td>5.4</td>
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<tr>
<td>Dro-in fuels produced from biomass, using catalytic reforming, or microbial conversion of sugars to diesel</td>
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<td>6.7</td>
</tr>
</tbody>
</table>

*The Ranking Score is the weighted average calculated by dividing the sum of all weighted ratings by the number of total responses.
THE 2011-12 50 HOTTEST COMPANIES IN BIOENERGY

1. Solazyme
2. Amyris Biotechnologies
3. Gevo
4. POET
5. LS9
6. Novozymes
7. Enerkem
8. LanzaTech
9. UOP
10. ZeaChem
11. Codexis
12. Abengoa Bioenergy
13. KiOR
14. Virent Energy Systems
15. Sapphire Energy
16. Ceres
17. Coskata
18. DuPont Danisco Cellulosic Ethanol
19. Terrabon
20. Mascoma
21. Cobalt Technologies
22. Petrobras
23. Joule Unlimited
24. BP Biofuels
25. Neste Oil
26. Waste Management
27. Rentech
28. Qteros
29. INEOS Bio
30. Genencor
31. Genomatica
32. Shell
33. Synthetic Genomics
34. Chemtex
35. Algenol
36. Elevance Renewable Sciences
37. OriginOil
38. SG Biofuels
39. Cosan
40. HCL CleanTech
41. Fulcrum Bioenergy
42. Cargill
43. Chevron
44. Bluefire Renewables
45. Dynamic Fuels
46. Mendel
47. OPX Biotechnologies
48. Inbicon
49. Renmatix
50. Monsanto
THE 30 HOTTEST COMPANIES IN RENEWABLE CHEMICALS AND BIOBASED MATERIALS, 2011-12

1. Genomatica
2. Solazyme
3. Amyris
4. Gevo
5. LS9
6. Dupont
7. Codexis
8. Genencor
9. Novozymes
10. ZeaChem

11. Cargill
12. Cobalt Technologies
13. Waste Management
14. Ceres
15. Elevance Renewable Sciences
16. Dow Chemical
17. Enerkem
18. Coskata
19. OPX Biotechnologies

20. DSM
22. Myriant
22. Cosan
23. Mascoma
24. KiOR
25. DuPont Danisco
26. Virent
27. LanzaTech
28. POET
29. Metabolix
30. Honeywell’s UOP
THE 50 HOTTEST COMPANIES IN BIOENERGY  2010-2011

1. Amyris
2. Solazyme
3. POET
4. LS9
5. Gevo
6. DuPont Danisco
7. Novozymes
8. Coskata
9. Codexis
10. Sapphire Energy

11. Virent
12. Mascoma
13. Ceres
14. Cobalt Technologies
15. Honeywell's UOP
16. Enerkem
17. BP Biofuels
18. Genencor
19. Petrobras
20. Abengoa Bioenergy

21. Qteros
22. Joule Unlimited
23. Shell
24. BlueFire Renewables
25. Rentech
26. Algenol
27. ZeaChem
28. Parabel
29. Neste Oil
30. Synthetic Genomics

31. LanzaTech
32. Iogen

33. OriginOil
34. Range Fuels
35. ExxonMobil
36. Cargill
37. SG Biofuels
38. Butamax
39. Terrabon
40. Cosan

41. Verenium
42. Waste Management
43. IneosBio
44. Dynamic Fuels
45. Fulcrum Bioenergy
46. KL Energy
47. KiOR
48. Chevron
49. Monsanto
50. Inbicon
THE 2009-10 50 HOTTEST COMPANIES IN BIOENERGY

1. Solazyme
2. POET
3. Amyris Biotechnologies
4. BP Biofuels
5. Sapphire Energy
6. Coskata
7. DuPont Danisco
8. LS9
9. Verenium
10. Mascoma
11. Novozymes
12. UOP Honeywell
13. Gevo
14. Range Fuels
15. Abengoa Bioenergy
16. Parabel
17. Synthetic Genomics
18. Petrobras
19. Bluefire Renewables
20. ZeaChem
21. Virent Energy Systems
22. Qteros
23. Iogen
24. Algenol
25. Enerkem
26. Genencor
27. Shell
28. Ceres
29. ExxonMobil
30. Cobalt Technologies
31. Aurora Algae
32. Joule Biotechnologies
33. Syngenta
34. KL Energy
35. Codexis
36. IneosBio
37. Renewable Energy Group
38. Rentech
39. Praj Industries
40. Neste Oil
41. LanzaTech
42. OriginOil
43. Choren
44. Solix
45. Chemrec
46. Dynamotive
47. Terrabon
48. Fulcrum Bioenergy
49. SG Biofuels
50. Inbicon
THE 2008-09 50 HOTTEST COMPANIES IN BIOENERGY

1. Coskata
2. Sapphire Energy
3. Virent Energy Systems
4. POET
5. Range Fuels
6. Solazyme
7. Amyris Biotechnologies
8. Mascoma
9. DuPont Danisco
10. UOP
11. ZeaChem
12. Aquaflow Bionomic
13. Bluefire Ethanol
14. Novozymes
15. Qteros
16. Petrobras
17. Cobalt Biofuels
18. Iogen
19. Synthetic Genomics
20. Abengoa Energy
21. KL Energy
22. Ineos
23. GreenFuel
25. LS9
26. Raven Biofuels
27. Gevo
28. St.1 Biofuels Oy
29. Primafuel
30. Taurus Energy
31. Ceres
32. Syngenta
33. Aurora Biofuels
34. Bionavitas
35. Algenol
36. Verenium
37. Simply Green
38. Carbon Green
39. SEKAB
40. Osage Bioenergy
41. Dynamotive
42. Sustainable Power
43. ETH Bioenergia
44. Choren
45. OriginOil
46. Propel Fuels
47. GEM Biofuels
48. Lake Erie Biofuels
49. Cavitation Technologies
50. Lotus/Jaguar – Omnivore
THE 40 HOTTEST PARTNERS IN BIOENERGY, 2012-13

1. Novozymes
2. US Navy
3. Ceres
4. Waste Management
5. US Department of Energy
6. Khosla Ventures
7. Solazyme
8. Genencor - Dupont Industrial Biosciences
9. BP
10. Dow Chemical
11. Valero
12. Honeywell's UOP
13. USDA
14. DOD
15. POET Biomass
16. Boeing
17. Green Plains Renewable Energy
18. P&G
19. Coca-Cola
20. Bunge
21. Codexis
22. John Deere
23. Gevo
24. Stoel Rives
25. POET-DSM
26. Kleiner, Perkins
27. Pacific Northwest National Lab
28. Oak Ridge National Lab
29. Shell
30. Harris Group
31. Propel Biofuels
32. Total
33. Caterpillar
34. BASF
35. Mintz Levin
36. ArborGen
THE HOTTEST PARTNERS IN BIOENERGY, 2012-13 – BY CATEGORY

Distribution & marketing
1. Green Plains Renewable Energy
2. Propel Biofuels
3. Blue Ridge Biofuels

Engineering, Procurement & Construction
1. POET-DSM
2. Harris Group
3. AMEC

Enzymes & Sugars
1. Novozymes
2. Genencor
3. Codexis

Feedstocks - Energy crops
1. Ceres
2. Solazyme
3. ArborGen

Feedstocks - Residues
1. Waste Management
2. POET Biomass
3. Catchlight Energy

Financing - Early-Stage
1. DOE
2. Khosla Ventures
3. Kleiner, Perkins
4. BP Technology Ventures
5. Burrill & Co

7. Financing - Late-Stage, Commercialization & Strategic Investment
1. BP Biofuels
2. USDA
3. Valero
4. Waste Management
5. US Department of Defense

Lab Services
1. MBI
2. Southwest Research Institute
3. Intertek

Pre-treatment Systems
1. POET-DSM
2. BlueFire Renewables
3. Catchlight Energy

Professional Counselors & Services
1. Stoel Rives
2. Mintz Levin
3. Wilson, Sonsini

Separation, informatics & catalysis systems and services
1. Koch Membrane Systems
2. BASF
3. Albemarle

Processing systems and services
1. Honeywell's UOP
2. Gevo
3. Mascoma

Vehicle & vehicular equipment systems
1. John Deere
2. Caterpillar
3. Ford

R&D Partners
1. Pacific Northwest National Lab
2. Oak Ridge National Lab
3. Argonne National Lab

15. Strategic customers—(fuels)
1. US Navy
2. BP
3. Valero
4. Boeing

16. Strategic customers—(bio-based products)
1. Dow Chemical
2. P&G
3. Coca-Cola
4. Bunge
### The Advanced Biofuels Tracking Database

Projected production volumes, 2009-2015 (in millions of gallons per year)

*Source: Biofuels Digest*

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<td>Abengoa - pilot</td>
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<td>Algae.Tec - demonstration</td>
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**Hottest Companies in Bioenergy 2012-13**

- **Elevance Renewable Sciences**
- **Elevance Renewable Sciences**
- **Emerald Biofuels**
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50 Hottest Companies in Bioenergy 2012-13 • Selector Book 21
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THE TOP 100 PEOPLE IN BIOENERGY
as voted by the readers and editors of Biofuels Digest

1. Tom Vilsack, US Secretary of Agriculture
2. Jeff Broin, CEO, POET
3. Bob Dinneen, President, Renewable Fuels Association
4. Miguel Soldateli Rossetto, CEO, Petrobras Biocombustíveis
5. Jonathan Wolfson, CEO, Solazyme / Harrison Dillon, PhD, CTO
6. Steven Chu, US Secretary of Energy
7. Marcos Lutz, CEO, Cosan
8. Alan Shaw, PhD, CEO, Codexis
9. Marcos Jank, President, UNICA
10. Vincent Chornet, CEO, Enerkem / Esteban Chornet, CTO
11. Steen Riisgaard, CEO / Steen Skjold-Jørgensen, VP for R&D Biofuels, Novozymes
12. Philip New, CEO, BP Biofuels / Sue Ellerbusch, President, BP Biofuels America
13. Brent Erickson, VP Industrial Biotechnology, BIO
15. Mike McAdams, President, Advanced Biofuels Association
16. Vinod Khosla, Managing Partner, Khosla Ventures
17. Jay Keasling, PhD, Professor, UC Berkeley
18. Patricia Woertz, CEO, Archer Daniels Midland
19. John Melo, CEO, Amyris / CTO Neil Renninger
20. Paul Woods, CEO, Algenol Biofuels
21. Pat Gruber, PhD, CEO, Gevo / Jack Huttner, EVP Corporate Development and Public Affairs
22. Bruce Dale, PhD, Michigan State University
23. Jim Sayre, Senior MD, Cargill Ventures / Ian Purtle, Director of Sustainable Energy
24. Rich LaDuca, Genencor / Bjarne Adamsen, Danisco
25. Joe Skurla, CEO, DuPont Danisco Cellulosic Ethanol
26. Rob Vierhout, Secretary General, EBIO
27. Valerie Reed, DOE Biomass Program / Paul Bryan
28. Lee Edwards, CEO, Virent / Randy Cortright, PhD, CTO, Virent Energy Systems
29. Bill Sims, CEO, Joule Unlimited
30. Collin Peterson, Stephanie Herseth-Sandlin, Earl Pomeroy, US House of Representatives
31. Mary Rosenthal, Exec Director, Algal Biomass Organization
32. Bill Haywood, CEO, LS9
33. Chuck Grassley, John Thune, Jeff Bingaman, Tim Johnson, US Senators
34. Lisa Jackson, US EPA Administrator
35. Ray Mabus, US Secretary of the Navy
36. Barry Cohen, Executive Director, National Algae Association
37. Chris Somerville, PhD, Professor, UC Berkeley Director, EBI
38. Jennifer Holmgren, CEO, Lanzatech / Sean Simpson CTO, founder
39. Joe Jobe, CEO, National Biodiesel Board
40. Rich Altman, Exec Director, CAAFI
41. Wesley Clark, Co-chairman, Growth Energy / Tom Buis, CEO
42. Jim Stewart, Chairman, Bioenergy Producers Association
43. Hugh Grant, CEO, Monsanto
44. Lee Lynd, PhD, Professor of Engineering, Dartmouth College
45. Alwin Kopse, Exec. Director, Roundtable on Sustainable Biofuels
46. Dan Adler, California Clean Energy Fund
47. Arnold Klann, CEO, Bluefire Ethanol
48. Nancy Young, VP, Environmental Affairs, Air Transport Association / John Heimlich Chief Economist
49. Riggs Eckelberry, CEO, OriginOil / Brian Goodall, PhD, CTO
50. Jose Olivares, PhD, Director, National Alliance For Advanced Biofuels and Bioproducts
51. Craig Venter, PhD, CEO, Synthetic Genomics / Emil Jacobs, VP R&D, ExxonMobil
52. Jim Dumesic, PhD, University of Wisconsin-Madison
53. Jim Matheson, General Partner, Flagship Ventures / David Berry, PhD, Partner
54. Richard Hamilton, CEO, Ceres
55. John Doerr, Managing Partner, Kleiner Perkins
56. Steve Burrill, Managing Partner, Burrill & Co / John Hamer, PhD, Managing Director / Roger Wyse, Managing Director / Greg Young, Managing Director
57. Bill Roe, CEO, Coskata / Wes Bolsen, CMO Coskata
58. Doug Cameron, CEO, Alberti Advisors
59. Tom Foust, PhD, NREL; Director, National Advanced Biofuels Consortium
60. Al Darzins, PhD, NREL / Philip Pienkos, PhD
61. Robert Brown, PhD, Professor, Iowa State University
62. Kristina Burow, Partner, ARCH Venture Partners / Bob Nelsen
63. Ganesh Kishore, PhD, CEO, Malaysian Life Sciences Fund
64. Stephen Mayfield, PhD, Professor, UCSD
65. John McCarthy, CEO, Qteros / Kevin Gray, CTO
66. Javier Salgado, CEO, Abengoa Bioenergy
67. Fred Cannon, PhD, CEO, KiOR
68. Bill Glover, MD, Environmental Strategy Boeing
69. Tom Baruch, CEO, CMEA
70. Heather Brodie, CEO, Biofuels Association of Australia
71. David Aldous, CEO, Range Fuels
72. Jim Imbler, CEO, ZeaChem
73. Bryan Willson, CTO Solix / Doug Henson CEO
74. Bill Brady, CEO, Mascoma
75. Bill Lese, MD, Braemar Energy Ventures
76. Rick Wilson, CEO, Cobalt Technologies
77. Matti Lievonen, CEO, Neste Oil
78. Pramod Chaudhari, Executive Chairman, Praj Industries
79. Jack Oswald, CEO, SynGest
80. Bill Hagy, Director, USDA Director of Alternate Energy Policy / Dallas Tonsager, USDA Under Secretary for Rural Development
81. Lonnie Ingram, PhD, Professor, University of Florida
82. Sean O’Hanlon, Executive Director, American Biofuels Council
83. Kirk Haney, CEO, SG Biofuels
84. Joanne Ivancic, Exec Dir, Advanced Biofuels USA
85. John Scott, CEO, PetroAlgae
86. Todd Taylor, Partner, Fredrickson & Byron
87. Rafaello Garofalo, Secretary General, European Biodiesel Board
88. Bliss Baker, MD, Global Renewable Fuels Alliance
89. Tim Cesarak, MD, Organic Growth Group, Waste Management
90. Philip Wolfe, CEO, UK Renewable Energy Association
91. Phil Bredesen, Governor of Tennessee / Kelly Tiller, CEO Genera Energy, Tim Rials, University of Tennessee
92. John Benemann, PhD, CEO, Benemann Associates
93. Brian Bilbray / Harry Teague / Jay Inslee / Dave Reichart / Mary Bono Mack, US House of Representatives
94. Bill Holmberg, ACORE Biomass Coordinating Council
95. Charles Wyman, Professor, UC Riverside
96. Gary Luce, CEO, Terrabon
97. David Tilman, PhD, Professor, University of Minnesota
98. Michael Wang, Argonne National Laboratory
99. Hunt Ramsbottom, CEO, Rentech
100. Brian Foody, CEO, Iogen
2012-13 CANDIDATE COMPANY PROFILES
Abengoa Bioenergy

Location:
St. Louis

Year founded:
USA - 1982
EU - 1998
Brazil - 2007

Type of technology(s):
a. Traditional fermentation of cereal grains and sugar cane for the commercial production of bioethanol

b. Traditional transesterification for the production of biodiesel from cereal and vegetable oils.

c. Multiple technology options for the commercial demonstration of cellulosic fuel production.

Fuel Type:
Bioethanol, biodiesel.

Major investors.
Parent Company is public (ABG) on the Madrid (SIBE) exchange.

Past milestones:

New Facility start-ups
1. Biodiesel (San Roque, Spain)
2. France ethanol plant (55 MMGPY)
3. Indiana and Illinois grass-roots ethanol facilities (88 MMGPY each)
4. Biomass commercial demonstration facility at BCyL, Spain

Commenced construction:
6. Two 70-MW Cogen facilities at both Brazil facilities
7. 110 MMGPY ethanol facility in Rotterdam

Instituted GHG Inventory system to support Sustainability goal.
9. Direct Blending of ethanol in Spain
Future milestones:
Completion of cellulosic biorefinery scheduled in Hugoton, KS in 2013

Business model:
Owner / Operator

Fuel cost:
Depends on feedstock cost and energy cost.

Competitive edge(s):
Distribution (own marketing company), economies of scale provides low-cost, quality (only Fuel Ethanol company that is registered to ISO-9001), locations (three continents), R&D investments.

Distribution, research, marketing or production partnerships or alliances.

Industrial Partners
• NatureWorks
• Novus International
• Monsanto
• Genencor
• Dyadic

Universities
• Auburn University
• Kansas State University
• University of Concepción
• University of Buenos Aires
• Lund University
• University of Sevilla
• University of Nebraska

Research Centers
• Asociación de Investigación y Cooperación Industrial de Andalucía - AICIA
• Centro de Investigaciones Energeticas, Medioambientales y Tecnologicas - CIEMAT
• National Renewable Energy Laboratory - NREL
• Pacific Northwest National Laboratory - PNL
• Argonne National Laboratory - ANL
• Instituto Catalysis y Petroquimicos - ICP
• Instituto Tecnologico de Aragon - ITA
• Centro de Investigacion y Desarrollo en Automocion - CIDAUT
• Washington University - St. Louis
• UOP

Stage
Commercial, pilot and demonstration.

Website URL.
www.abengoabioenergy.com
Albemarle Corporation

Company description:
Manufacturer of Specialty Chemicals

Address:
451 Florida St, Baton Rouge, LA 70801

Year founded:
1994. Albemarle was formed in 1994 as a the specialty chemicals spin off from Ethyl Corporation.

Chief Executive Officer and contact email:
Mark Rohr

Major Investors:
ALB NYSE

Type of Technology(ies):
Catalysts, Polymer Additives, Fine Chemicals. Subcategories for catalysis include catalysis for the production of Biofuels from a wide range of feedstocks, including second generation materials like wood, municipal waste, agricultural residue, and algae.

Feedstocks:
The catalytic technologies being developed for the conversion of 1st and 2nd generation feedstocks will be able to handle a wide variety of raw materials. The focus of the developments for the next generation of catalysts is directed at using renewable carbon sources that are not in competition with food.

Fuel Type (if applicable):
The heterogeneous catalytic technologies being developed by Albemarle and her partners are directed at the production of fungible fuels. This means the products can be mixed in any percentage with traditional fuel types. Albemarle’s researchers are targeting all types of fuel to be derived from renewable sources, so for example gasoline, diesel, aviation fuel and fuel for stationary power units are being developed. As this is still in full development, current processes producing FAME and ethanol are also under study.

Fuel Cost (if applicable - per US gallon):
A major target for the researchers of Albemarle is to create technology that will produce renewable fuels at a competitive pricing. At the moment, we consider all developments that start being economically attractive from a crude oil price around 70-80$/bl to be
worthwile.

Offtake partners (if applicable):
We are the world’s largest supplier of heterogeneous biofuel catalysts, as we are the co-developer and sole supplier of the Neste NExBTL units. We are also the leading catalyst developer in many consortia, notably the recently awarded DoE-funded NABC program. Next to these, we have many flourishing partnerships, unfortunately these often have a confidential nature.

Co-products (if applicable):
In the development of our catalysts, we closely adhere to the principles of Green Chemistry and Sustainable Business Practices. The products we develop are based on relatively benign chemistry and chemicals. Most catalytic materials are inorganic, and easily recyclable. From the earliest conception of catalyst development, the production, use, and disposal are taken into consideration.

3 Top Past Milestones
1. Largest global catalyst supplier to the biorefining market
2. New heterogeneous transesterification catalyst
3. New mixed alcohol catalyst production process for cellulosic biorefineries

Future Milestones
1. Improved catalyst for catalytic pyrolysis
2. Improved catalyst for pyrolysis oil upgrading
3. Improved catalysts for (bio)Syngas upgrading into hydrocarbons or alcohols
4. Improved NExBTL catalyst

Business Model:
Together with partners or in consortia we are developing heterogeneous catalysts that are essential to convert biomass into usable transportation fuels. Once a catalyst has proven its usability in a certain process we manufacture the catalysts for our partners.

Competitive Edge(s):
With over 50 years of experience in developing and manufacturing catalysts, Albemarle is leveraging its extensive knowledge of catalysis, catalyst preparation and production into the Biofuels arena. Toolled with state-of-the-art equipment like High Throughput Experimentation and analysis tools, Albemarle is well poised to quickly and efficiently develop and commercialize catalytic routes to renewable fuels from non-fossil carbon sources.

Distribution, Research, Marketing or Production Partnerships or Alliances. Includes, but not limited to:
1. Neste – Production
2. NREL led NABC Consortium
3. PNNL led consortium
4. EERC – Research
5. Velocys – Research
6. Biomass Technology Group (BTG) - Research
7. JDA with major US based oil refiner and biomass provider. (Confidential)

**Stage:**
Albemarle operates in all the aforementioned stages with respect to catalysis.

**Website URL:** www.albemarle.com
Algenol Biofuels Inc

Address: 28100 Bonita Grande Drive, Suite 200, Bonita Springs FL 34135

Year founded: 2006

Annual Revenues: N/A

Company description:

Algenol LLC is a global, development stage, industrial biotechnology company that makes biofuels and high-value industrial chemicals cost-effectively from abundant, renewable resources. Algenol uses hybrid blue-green algae and specially designed photobioreactors as a sustainable, proprietary platform for making its products from carbon dioxide, sunlight, and saltwater. The Company’s first product is ethanol for the biofuel and ethylene markets that it produces with its patented DIRECT TO ETHANOL® process.

Major Investors:

Privately held

Type of Technology(ies):

The DIRECT TO ETHANOL® technology uses the power of the sun, carbon dioxide, seawater and hybrid algae to produce ethanol and other green chemicals.

Feedstocks:

Algenol hybrid algae use carbon dioxide as a feedstock. The efficiency of carbon dioxide conversion to ethanol is quite high.

Products:

First product will be transportation ethanol for the growing fuel market. Algenol also has a small but focused group working on the green chemistry.

Product Cost (if applicable - per US gallon):

At commercial scale, Algenol intends to have capital cost between $4.00-$6.00 /gallons and operating cost under $0.90/gallon.

Offtake partners: N/A
Past Milestones
In the first quarter of 2011, Algenol completed the construction of its 49,000 sq. ft. research facility located in Lee County. This allowed Algenol to consolidate all its US operations that consist of engineering, aquaculture, physiology, analytical chemistry and molecular biology.

Construction on the 36 acre outdoor Integrated Biorefinery has begun in Fort Myers Florida (Lee County).

Algenol completed the acquisition of Cyano-Biofuels located in Berlin, Germany. The acquisition significantly increased Algenol’s research and development capacity and strengthened its access to European expertise in biotechnology and algal research.

Algenol completed an approximately $90 million private financing with a major multinational petroleum corporation that has become a new strategic partner for Algenol.

Future Milestones
Algenol intends to complete its DOE Biorefinery in 2013. At full scale, the facility will consist of 17 acres filled with photobioreactors, and will produce 100,000 gallons of ethanol per year.

We will have a commercial project producing ethanol by the 4th quarter of 2014

Business Model:
Algenol intends to either license its DIRECT TO ETHANOL® technology or contribute the technology for equity in production ventures with strategic partners.

Competitive Edge(s):
Algenol has pioneered the production of ethanol using cyanobacteria and has been issued several patents in the field. Algenol’s unique photobioreactor and its energy efficient separations technology result in the DIRECT TO ETHANOL® process having a net energy yield (energy out vs. energy in) of nearly 4 to 1. This combination of factors leads to a target cost of production of ethanol below $1.00 per gallon.

In collaboration with Georgia Tech, Algenol has published its Life Cycle Analysis (LCA) in a peer-reviewed journal demonstrating an 80% reduction in its carbon footprint when compared to gasoline.

Our DIRECT TO ETHANOL® technology has a no harvest strategy. Our hybrid algae acts as biocatalyst to fix carbon efficiently and produce our first molecule, ethanol.
Research, or Manufacturing Partnerships or Alliances:

Algenol has several collaborations with world-class companies and universities:
- Linde AG
- Valero
- BioFields
- Georgia Tech
- University of Colorado
- Florida Gulf Coast University

Stage:

Algenol is constructing its DOE Biorefinery which will produce 100,000 gallons of ethanol per year and consumes 2 tonnes of carbon dioxide a day.

Website URL: www.algenol.com

Chief Executive Officer: Paul Woods
Altranex

Address: 5200 Finch St. East, Suite 210, Toronto, ON M1S 4Z4 Canada

Year Founded: 2010

Company description:
Biodiesel, as it is produced today does not work in cold weather. Below 50F (10C), biodiesel begins to solidify rendering engines inoperable in cold weather. Small quantities of biodiesel (up to 5%) can be blended with petro-diesel without compromising engine performance. However, for industrial and commercial vehicles in North America, Europe and northern Asia, a sustainably-produced fuel that works well in cold weather is needed.

Altranex’s solution to this challenge is Green Kero™, a patent-pending sustainably-produced fuel that remains liquid to temperatures as low as -30F (-22C). Green Kero™ is produced from renewable sources such as jatropha, camelina, waste vegetable and algae oils and can replace diesel, biodiesel and ultra-low-sulfur kerosene for transportation fuels. Green Kero™ can be produced by adding one process step to existing biodiesel facilities. This approach results in a capital efficient business model for Altranex and our customers. Once in production, Green Kero™ will be competitive with crude oil at $56/bbl. Because of our unique, low-capital approach that takes advantage of existing infrastructure, Biofuels Digest, the most widely read biofuels daily, recently nominated Altranex as “one of the 12 hot bio-based technologies worth watching”.

Major Investors (if a public company, please provide trading symbol and exchange).
Privately held

3 Top Milestones for 2009-11
• Patents filed on process technology
• Process reduced to practice in laboratory

3 Major Milestone Goals for 2013-15
• Build strategic partnerships in renewable fuels industry
• Scale-up process to pilot production
• License technology to producers

Business Model: (e.g. owner-operator, technology licensor, fee-based industry supplier, investor) Technology licensor

Competitive Edge(s): Altranex produces a drop-in replacement diesel fuel from renewable resources with superior cold weather properties enabling broader adoption of renewable diesel fuels in North America and Europe.

Research, or Manufacturing Partnerships or Alliances.
Research partner: GreenCentre Canada

Stage (Bench, pilot, demonstration, commercial)
Bench-scale development & demonstration

Website URL: www.altranexenergy.com

Chief Executive Officer: Chad Joshi

Business development or sales contact: Chad Joshi

Product information

For each existing or planned product, please complete

Product Brand Name: Green Kero™

Product Description: drop-in replacement for diesel and kerosene with low cloud point

Product Applications: ground transportation including cars, trucks, off-road vehicles with compression-ignited engines

Unique Features (i.e., what separates this product from the competition, whether bio-based or incumbent fossil-based products – e.g. cost, performance features).

Green Kero™
- can be used directly in compression-ignited engines or can be blended with diesel fuel in any proportion;
- meets renewable fuel standards;
- improves the cold weather properties of diesel fuel;
- eliminates the need for cold flow additives that add cost to winter diesel production;

Feedstocks and bio-based content (e.g. “20% soy-based”)
waste fats oils and greases including high FFA supplies such as trap grease and brown grease, yellow grease, WVO, virgin non-food plant oils such as jatropha, camelina and algae.

Wholesale or retail Product price: (if applicable)

Parity price, e.g. competitive with $XX oil: (if applicable, in BPOE, US$)
$56/bbl crude oil
Website URL: www.altranexenergy.com

Product photo URL: (if available)
http://www.altranexenergy.com/cold%20fuel%20jpg.jpg

Head of sales, and contact email
Chad Joshi, CEO
Amyris, Inc.

Address: 5885 Hollis Street, Emeryville, CA

Year founded 2003

Company description: Amyris is an integrated renewable chemicals and fuels company founded in 2003 and based in Emeryville, CA, with additional operations in Chicago, IL and Campinas, Brazil. Amyris has over 400 employees, with three-quarters of its employees located in the United States. Amyris subsidiaries include Amyris Brasil Ltda., a wholly-owned Brazilian company through which Amyris conducts its Brazilian operations for the manufacture and trade of products; and Amyris Fuels, LLC, a wholly-owned subsidiary through which Amyris is building its U.S. fuels distribution capabilities.

Major Investors: Amyris’s stock is traded publicly on the NASDAQ stock exchange under the symbol AMRS.

Type of Technology(ies): Amyris has developed genetic engineering technologies that enable modification of the way microbes process (i.e., metabolize) sugar. By controlling these metabolic pathways, Amyris is able to design microbes, primarily yeast, to be tiny living factories that convert plant-sourced sugars from crops such as sugarcane or sweet sorghum into target molecules. Using its industrial synthetic biology platform, Amyris develops yeast strains designed to produce a broad range of molecules. The first molecule that Amyris is focusing on is Biofene™, Amyris-brand farnesene, a hydrocarbon building block that can replace petrochemicals in a wide variety of products in the cosmetics, flavors and fragrances, consumer product, polymers, lubricants and fuel markets.

Feedstocks: Amyris can use a broad range of plant sugars to produce its products. Amyris expects to scale production initially using Brazilian sugarcane as a feedstock.

Products (e.g. ethanol, biobutanol, biodiesel, renewable diesel, renewable jet fuel, power, organic acids, bioplastics etc.): Renewable fuels, lubricants, polymers and plastic additives, consumer products, flavors & fragrances and cosmetics.

Product Cost (if applicable - per US gallon): Please see quarterly earnings statement

Offtake partners (if applicable): As part of its go-to-market strategy capitalizing on the flexibility of its proprietary molecule, Amyris has entered a number of off-take and co-development agreements with partners in specific, high-value vertical markets such as cosmetics, consumer products, flavors and fragrances and lubricants. Amyris has an off-take agreement with Shell for the supply of Amyris No Compromise® diesel, with M&G Finanziaria S.R.L. to incorporate Biofene® as an ingredient into M&G PET processing and with The Procter & Gamble Company for use of Biofene in certain specialty chemical
applications within P&G’s products. Amyris also has co-development agreements with companies in a variety of markets, including with Total to develop renewable jet fuel and with Kuraray to develop polymers to replace petroleum-derived feedstock such as butadiene and isoprene, allowing Amyris to target high-value markets while ramping up production of renewable diesel.

**Past Milestones:**

1. Completion of initial public offering.
2. First purchase order for Amyris’s first commercial product, renewable squalane, followed by sales of Amyris renewable diesel and lubricants.
3. Initial commercial production facilities in Brazil, Spain and U.S.

**Future Milestones:**

1. Build and operate two additional productions sites in Brazil (SMA and Paraiso).
2. Remain on track for target production costs while meeting increasing customer demand.
3. Add C5 and C10 molecules along with new products and customer agreements.

**Business Model**
Amyris partners with biofuel producers to build new, “bolt-on” facilities adjacent to existing mills, instead of building new “greenfield” facilities, thereby reducing the capital required to establish and scale production, while simultaneously offering partners the opportunity to diversify and grow their product lines. Each of these steps in the production process – from the feedstock, through fermentation, to recovery and finishing – use processes that are already used by other industries today, enabling cost-effective scaling of production. Amyris’s streamlined production process employs an innovative take on established infrastructure and allows for lower start-up and capital costs and more efficient processes. In addition, Amyris’s partnership model incorporates cultivating long-term relationships with customers and co-developing ingredients with them to meet specific product development goals.

**Competitive Edge(s):** Biofene provides a number of compelling advantages when compared to other renewable chemical and fuel alternatives, most notably that it is an oil. It can therefore be a drop-in replacement for many petroleum products, and it fits into the existing petroleum transport and distribution infrastructure. It is also an extremely flexible molecule that, with a few simple finishing steps, can replace petroleum derived chemicals in a number of markets, including ingredients in cosmetics, polymers, lubricants and consumer products, and renewable diesel and jet fuel. Amyris’s technology has been designed to be feedstock-agnostic and its platform is extremely flexible; Biofene is just one of thousands of molecules that Amyris can produce.

**Research, or Manufacturing Partnerships or Alliances:** Amyris is a member of the
National Advanced Biofuel Consortium under the Department of Energy (DOE) and NREL as well as a recipient of an Integrated Biorefinery (IBR) grant from the DOE. Amyris has ongoing research collaborations in Australia, Brazil and the U.S., and is a founding member of the Advanced Biofuel Association (ABFA), Biotechnology Industry Organization (BIO) and Diesel Technology Forum (DTF), among others. Amyris has manufacturing partnerships with Glycotech, Biomin, Sao Martinho, Tate & Lyle and Antibioticos.

Stage (Bench, pilot, demonstration, commercial): Commercial

**Website URL:** www.amyris.com

**Chief Executive Officer:** John Melo
Aurora Algae

Based in:
3225 Investment Blvd. Hayward, CA. 94545

Company description: Aurora Algae (formerly known as Aurora Biofuels) is a producer of high-performance, premium algae-based products for the pharmaceutical, nutrition, aquaculture and fuels markets.

Business: Aurora burst onto the scene in June 2008 with the announcement that it had raised $20 million in series A financing from Oak Investment Partners, Noventi and Gabriel Venture Partners. Gabriel and Noventi had participated in a seed stage round. Aurora uses technology developed by Berkeley professor Tasios Melis for an open-pond algae production system to produce a range of products from algae. The company says that its process reduces the cost of biodiesel production by half, compared to current methods.

Model: Owner-operator

Past milestones: AlwaysOn named Aurora Algae in the AlwaysOn 100.

The company completed an 18-month pilot in early 2009, and VC backer Jim Long of Gabriel Venture Partners told a group of biofuels execs at Biofuels: Science and Innovation that algae was "the focus" at GVP as far as biofuels.

In California, Aurora Algae announced that it has succeeded in optimizing its base algae strains to more than double CO2 consumption and fuel production, and has proven these results in an outdoor open system over the last several months. The company said that it has developed a proprietary process which allows for the superior selection and breeding of non-transgenic algae.

Aurora Algae investors include Oak Investment Partners, Noventi Ventures and Gabriel Venture Partners.

In September 2010, the company confirmed its emergence as Aurora Algae. The company also said that it would be transitioning from a pilot technology development to full-scale commercialization of the Company’s proprietary algae products, including high concentration eicosapentaenoic acid (EPA Omega-3 fatty acids), high-density proteins, fish meal and renewable fuels. The company’s key technology – an optimized strain of salt-water algae that is lighter in color than wild-type algae–allows deeper penetration of sunlight, thereby extending the zone for algae reproduction and increasing yield. The company said it has also adapted a technique used in the waste-water industry for low-cost algal harvesting.

In October 2010, Aurora Algae announced the company is expanding operations with the opening of a new regional headquarters in Perth, Australia. The new office, to be led by Australian Managing Director and Aurora Algae Co-Founder Matthew Caspari, will oversee the construction
and operation of Aurora Algae’s first commercial-scale facility in the Northwest region of the country. In Q3, the company announced an expansion of their product portfolio to include renewable fuels, high concentration Omega-3 fatty acids, high-density proteins and fish feed.

In March, Aurora Algae launched a line of high-performance, premium algae-based products to address the pharmaceutical, nutrition, aquaculture and fuels markets. The portfolio is comprised of four “algae-to-product” (A2 product) categories:

- **A2 Omega-3™**—a family of Omega-3 oils aimed at the nutraceutical and pharmaceutical markets with the goal of providing a natural, sustainable and cost-effective alternative to fish oil and fermented products. The first offering in this family, A2 EPA Pure™ will make the benefits of EPA available to a broader market since it is derived from an allergen-free, vegetarian source.
- **A2 Feed™**—a family of protein-rich algal grains specifically designed for the animal and aquaculture markets to supply a high-quality feedstock to raise sustainably farmed fish and healthy animals.
- **A2 Fuel™**—a family of biomass and biodiesel applications providing renewable alternatives for transportation and other energy-related markets.
- **A2 Protein™**—a family of protein-rich powder products for the food and beverage industry.

In April, Aurora Algae opened its demonstration facility in Karratha, Western Australia, where the Company’s algae-based biomass is being harvested for products in the nutraceutical, pharmaceutical, aquaculture and renewable energy markets. The company has also secured an option agreement on over 1,500 acres of land located near its demonstration facility, which will allow it to begin the process of constructing a full-scale commercial facility equipped to manufacture thousands of tons of algae-based biomass annually.

Aurora also announced that it had received $946,000 AUD in additional LEEDS grant funding, and $750,000 AUD in research and development (R&D) tax credits from the Australian government for hitting key production and construction milestones. The company previously announced $750,000 AUD in LEEDS funding as part of a total potential grant of $2 million AUD.

**Future milestones:**
Aurora produces 15 metric tons of biomass per month from its open and operating demonstration facility in Karratha Western Australia. The Company has secured land and intends to break ground on a full scale commercial facility close to the current site. This facility will size up from the current six - 1 acre ponds to 250 acres at opening and will continue to scale exponentially.

**Metrics:** Aurora leapt into the news this spring with a projected $1.30 cost for algae in its second-generation technology, due in 2013.
Website:
www.auroraalgae.com
Avantium

Company description:
Avantium is a leading technology company specialized in the area of advanced high-throughput R&D. The company develops and commercializes YXY – its brand name for chemical building blocks for making green materials and fuels that can compete on price and performance. Avantium has demonstrated the value and commercial potential of its unique technology and knowledge by collaborating with leading companies in the energy and chemical industries. Avantium has a global customer base for its profitable R&D services and systems offering, including market leaders such as BP, Shell and Sasol. Avantium offices and headquarters are based in Amsterdam, the Netherlands.

Address:
Zekeringstraat 29, 1014 BV, Amsterdam, The Netherlands

Year founded:
2000

Chief Executive Officer:
Tom van Aken

Major Investors (if a public company, please provide trading symbol and exchange).
Aescap (Netherlands), Capricorn (Belgium), DFJ Esprit (UK), ING (Netherlands)

Type of Technology(ies)
Chemical catalysis

Feedstocks:
Carbohydrates from various types of biomass

Fuel Type:
Furan-based fuel components for diesel, jet fuel and gasoline

Fuel Cost (if applicable - per US gallon): EUR 1.2 - 1.5 (USD 1.7 - 2.1) per Gallon Diesel
Energy Equivalent (corrected for energy content of regular diesel)

Offtake partners (if applicable)

Co-products (if applicable)

Past Milestones
1 Construction pilot plant 2 Proven application potential for YXY polyesters: bottles, fibers and film
3 Results of engine tests (diesel trucks and jet engines)

Future Milestone Goals
1 Construction of semi-industrial plant 2 Joint development partnerships for YXY materials and chemicals (bottles, fibers, coatings, engineering plastics, plasticizers)
3 Extensive engine test programs in partnership with automotive and fuel companies

Business Model: (e.g. owner-operator, technology licensor, fee-based industry supplier, investor)
Current status: Avantium is the exclusive owner of its proprietary YXY technology to produce chemical building blocks for making green materials and fuels.

Avantium is looking for partners that can produce YXY building blocks on industrial scale, whereby Avantium will be the technology licensor.

Competitive Edge(s):
The current process yield of Avantium’s YXY technology will allow competing on basis of price and performance with oil-based chemicals and fuels.

Avantium’s catalytic process has a number of economic benefits: short reaction times, it can be produced at very large scale, and it has a natural fit with existing installations and infrastructure of the petrochemical industry. All these benefits allow for competing on the basis of price.

Avantium has proven that materials and fuels containing YXY building blocks have excellent properties and unique benefits that enable them to compete with oil based products on basis of performance.

Distribution, Research, Marketing or Production Partnerships or Alliances.
Joint Application Development Agreements with: NatureWorks (polyesters), Teijin (high-performance polymers) and DAF Trucks (engine testing of fuels).

Feedstock: partnerships with Royal Cosun (agricultural waste streams) and ECN (Energy Research Center Netherlands (pretreatment of lignocellulosic biomass)

Life cycle assessment: Utrecht University (Patel, Faaij):

Stage (Bench, pilot, demonstration, commercial):
Pilot

Avello Bioenergy, Inc.

Address:
BioCentury Research Farm (BCRF), 1327 U Avenue, Boone, Iowa 50036

Year founded:
2009

Annual Revenues:
N/A, pre-revenue

Company description:
Avello Bioenergy provides renewable, profitable petroleum replacement feedstocks for asphalt, fuel, chemical and soil amendment applications through low cost thermal conversion of non-food biomass.

Major Investors (if a public company, please provide trading symbol and exchange).
Equity Dynamics, Inc.

Type of Technology(ies)
Avello™FRAC - Proprietary fast pyrolysis process to produce multiple distinct fractions of pyrolysis oil and biochar.
Bioasphalt™ - Use of pyrolysis oil fractions in asphalt applications

Feedstocks:
AvelloFRAC is feedstock flexible with minimal preprocessing requirements. No chemical or biological pretreatment is required. Acceptable feedstocks include: agricultural residues (corn stover), mill residues, forestry residues (pine), and energy crops (switchgrass, hybrid poplar).

Products (e.g. ethanol, biobutanol, biodiesel, renewable diesel, renewable jet fuel, power, organic acids, bioplastics etc)
Bioasphalt™ - Renewable additive or replacement for petroleum based asphalt binders in paving and roofing material applications. Meets or exceeds ASTM and AASHTO specifications and performs as an additive, modifier, extender or full replacement of petroleum asphalt binders depending on application. Use of Bioasphalt can lower the production temperature of hot mix asphalt (HMA), which may decrease paving costs and reduce greenhouse gas emissions because less energy input is required. Bioasphalt may also provide an anti-oxidant effect which could increase the service life of pavement. The grade range of asphalt may be extended with the addition of Bioasphalt.
Chemical Feedstocks - AvelloFRAC pyrolysis oils have improved properties for upgrading or use "as-is" in chemical and fuel applications. Potential markets include bulk and specialty chemicals, lignin based chemicals, phenolic resins, adhesives, and flavor & fragrance. The properties of AvelloFRAC fractions show potential for easier upgrading to drop-in biofuels and fuel additives.

Biofuel Oil™ - Heavy and light versions of Biofuel Oil are under development for use as petroleum replacements and blending stocks in existing applications. Target applications include stationary engines, commercial and industrial heat & power, and heavy marine engines. Biofuel Oil has lower water and acid content than conventional pyrolysis oil resulting in a less corrosive and higher energy density fuel. Low sulfur content could result in lower SOx emissions compared to fuel oils and raw biomass.

Biochar - Biochar will be marketed as a soil amendment, fuel source for heat and power and as a potential carbon sequestration agent. Fuel uses of biochar include combustion in furnaces and boilers and co-firing with coal as a renewable fuel in existing power plants.

**Product Cost** (if applicable - per US gallon): (Costs per US gallon for fuels, costs per pound for chemicals and/or biomaterials. If you do not manufacture or have long-term stable feedstock pricing, please use the latest December futures contract pricing for traded feedstocks, or $55/ton for untraded biomass - or provide notes on your own feedstock pricing assumptions).

Economic projections indicate products will be competitive in the $50 - $65/bbl oil equivalent range, without subsidies. Assumes $60 - $70/dry ton for feedstock cost.

**Offtake partners** (if applicable)
N/A

**Past Milestones**

1. Secured seed and grant funding exceeding $3 MM, including contract with the Iowa Power Fund for project to design and build Demonstration Plant
2. Secured licenses from Iowa State University
3. Demonstrated semi-continuous two-week ¼ TPD AvelloFRAC pilot plant operation, which produced Bioasphalt™ subsequently used in an asphalt paving demonstration (Des Moines, October 2010)

**Future Milestones**

1. Startup and operation of demonstration plant, pre-commercial product testing and certification
2. Secure additional funding to complete design for first commercial plant
3. Start construction on first phase of commercial plant
Business Model: (e.g. owner-operator, technology licensor, fee-based industry supplier, investor)
Build, Own and Operate with strategic licensing and JV formation

Competitive Edge(s):
- Sustainable, proprietary and renewable asphalt binder for pavement construction and roofing materials
- Proprietary process technology isolates majority of water and acids to single pyrolysis oil fraction, which improves properties of other fractions for direct use and upgrading.
- Potential for profitability at relatively small scale (250 TPD and larger).
- Multiple pyrolysis oil fractions allows for custom blending and unique uses
- Groups of chemical compounds are concentrated into specific fractions, allowing for targeted and specialized end-use applications in chemicals and materials markets.

Research, or Manufacturing Partnerships or Alliances.
Avello Bioenergy has executed a contract with the Iowa Power Fund for a $2.5 MM grant to design, build and operate a 2.5 TPD Demonstration Plant at the Iowa State University BioCentury Research Farm in Boone, IA. The 3-year project will design, build and operate a 2.5 dry ton/day Demonstration Plant to provide large amounts of product and, test these products in semi-commercial market applications. A strong coalition of industrial and academic partners have committed $2.8 MM of in-kind contributions for engineering support and use of equipment or facilities and market testing of Avello’s products. Avello Bioenergy is in the process of raising the capital match required to initiate this project.

Continental Technologies and Emerson Process Management will assist Avello in engineering, construction and start-up of the plant. The Demonstration plant will be operated to produce Avello’s petroleum replacement products for pre-commercial testing. Bioasphalt® will be used in paving demonstrations coordinated by government agencies and the Asphalt Paving Association of Iowa (APAI), and a leading building materials manufacturer will evaluate roofing shingle applications. Cargill plans to test Biofuel Oil™ for clean power generation at their facility in Eddyville, Iowa. Borregaard LignoTech will evaluate Avello pyrolysis oil fractions for use in renewable chemicals and specialty applications. Virent Energy Systems will investigate production of hydrogen and advanced biofuels from Avello pyrolysis oil fractions.

Biochar will be tested as a soil improvement and carbon sequestration agent by USDA ARS through a Collaborative Research Agreement. Iowa State University researchers will be involved with feedstock harvest, storage and transportation; and testing of Bioasphalt, Biofuel Oil, and Biochar. Iowa Farm Bureau will assist in education and outreach by reaching out to all stakeholders in the biomass fast pyrolysis value chain.

Stage (Bench, pilot, demonstration, commercial)
Bench scale and pilot scale process and product demonstrations complete. Demonstration
plant and pre-commercial product testing under development.

**Website URL**
www.avellobioenergy.com
Biofuel Advance Research & Development (BARD)

Company description:
Algae Biofuel Company

Address:
1167 Bridge Street, Philadelphia, PA 19124

Year founded:
2007

Chief Executive Officer:
Surajit Khanna

Annual Revenues: n/a

Major Investors:
BARD has filed its S-1 Registration statement with the SEC and is waiting for it to be “Effective”

Type of Technology(ies)
Closed loop system/Photobioreactors

Feedstocks:
Algae (multiple strains)

Fuel Type
Focus is currently biodiesel, investigating jet fuel opportunities

Fuel Cost (if applicable - per US gallon): N/D

Offtake partners (if applicable) FC Stone, Omega Seafoods

Co-products (if applicable) Algae oil, cake, oxygen, glycerin

Past Milestones (1) Received Algaepreneur Award from the National Algae Association (2) Received Air Quality Permit from the Department of Environmental Protection - Pennsylvania (3) Q4 expectation is to begin production of algae on a commercial scale, anticipated output of 48,000 gals/month.

Future Milestones (1) Completion and full production from 3 mgy facility in Q2 2011 (2) Completion and full production from 66 mgy facility by Q1 2012
Business Model: owner-operator, with focus on large scale production

Competitive Edge(s): Patent pending production process utilizing PBRs in a closed loop system, optimal location of facilities (co-located adjacent to both CO2 source and municipal waste water plant as well as next to a deep water port), scalable turnkey solution

Distribution, Research, Marketing or Production Partnerships or Alliances.

Stage  Demonstration with cross over to commercial in Q4

Website URL  www.bardholding.com
Bioalgene

Based in: Washington State

Business: Bioalgene cultivates algae to remediate pollution, and to produce fuel and other bioproducts. The company has developed proprietary methods to accelerate algae growth, has proven those at pilot level in a coal-fired generating environment, and is developing distinctive approaches to harvest and convert algae. It is a participant in multiple consortia seeking development and commercialization projects and grants.

Bioalgene is focused on cultivating algae to remediate pollution and produce bioproducts, including fuel. The company has developed proprietary methods to accelerate algae growth and is developing distinctive harvest and conversion systems.

The vision that draws research scientists, entrepreneurs and investors to algae remains as important as ever: to replace a significant portion of petroleum fuels with the next generation of renewable alternatives. Bioalgene has developed phased processes to:

- Use algae to capture and convert air pollution — particularly greenhouse gases
- Create profitable products from organic wastes
- Farm on a large scale in locations where raw materials are produced as wastes.

Bioalgene’s cultivation strategy is designed to minimize capital requirements and operating costs. Enroute to producing fuel, Bioalgene captures and converts CO2 today to generate voluntary carbon credits at high-volume industrial CO2 sources.

The company has grown algae in a production environment, and accomplished fourfold growth acceleration using a proprietary approach that included flue gases from a coal-fired power plant.

Bioalgene’s strategic advantage to high-volume greenhouse gas producers include:

- Volume capture at low cost
- Anticipatory carbon credits
- Products from pollutants.

The company creates value for customers and investors in three stages:

- Earning carbon credits from large-scale CO2 capture
- Producing fuel and products from algae grown at several facilities
- Producing and selling high-volume algae production systems.

Bioalgene’s approach to algae farming meets economic and environmental criteria, even in the midst of the recession. Plans include multiple sites growing high volumes of dense algae, using Bioalgene’s strains, equipment and end-to-end systems. The company’s triple-bottom-line global opportunity results from carefully planned and leveraged resources that provide substantial multipliers.
Model:
Project developer, strategic partner, service provider.

Past milestones:
1. Bioalgene’s initial work to prove growth methods and economics engaged partners from Washington State University and Seattle University.
2. Under a grant from Boeing, proved strain viability, growing conditions and yields from dozens of regional algae strains.
3. Demonstrated volume, high-yield growth in open-ponds.
5. Farmed algae in a production environment, accomplishing a fourfold acceleration in growth using flue gases directly from a coal-fired generating plant.

Future milestones:
1. Scale up algae production systems at the coal-fired generating plant where Bioalgene has previously captured CO2 and other GHG from flue gases in algae.

Metrics:
Based on our testbed and production level work, Bioalgene expects to convert each million pounds of CO2 into more than 10,000 gallons of fuel feedstock and 500 tons of bioproducts.
BioMCN

Based in: Netherlands

Business: Purification, evaporation and cracking (of crude glycerine) to obtain syngas which is used to synthesise bio-methanol

Past Milestones:

March 2008: proof of principle in our 20,000 t pilot plant,
October 2008: winner European Responsible Care Award,
July 2009: successful start-up commercial 200,000 t plant

Future milestones:

1. Selling bio-methanol on a large scale
2. Expanding current capacity,
3. Developing new technologies (possibly different feedstock)

Model: Owner-operator.

Quotable quotes:

"The only company in the world to produce bio-methanol on a commercial scale. The solution to comply with biofuels regulations, chemically identical to regular methanol, great performance as a fuel."
BioProcess Algae

**Company name:** BioProcess Algae

**Address:** 45 High Point Avenue, Portsmouth, RI 02871

**Year Founded:** 2008

**Annual Revenues:** $0

**Company description:** BioProcess Algae produces low-cost, high-quality algae feedstocks for a variety of downstream markets including food, feeds and fuels. BioProcess is based in Portsmouth, RI and is currently running a demonstration facility at the Green Plains Renewable Energy, Inc. ethanol plant in Shenandoah, Iowa. Grower Harvester™ bioreactors have been tied directly into the plant's CO2 exhaust gas since October 2009. Initial co-location strategy has focused on bridging First Generation biofuels to Next Generation biofuels and bioproducts.

**Major Investors** *(if a public company, please provide trading symbol and exchange).*
- Green Plains Renewable Energy (NASDAQ:GPRE)
- CLARCOR (NYSE:CLC)
- BioProcess H2O

3 Top Milestones for 2009-11

1. We announced commercial supply agreement for EPA-rich Omega-3 oils with KD-Pharma for use in concentrated EPA products for nutritional and/or pharmaceutical applications. *June 2012*
2. Groundbreaking on Five Acre Production Facility (Phase III) at Green Plains in Shenandoah, Iowa following the unveiling of our commercial scale bioreactors (Phase II) less than a year prior in April 2011. *February 2012*
3. Successful algae-based poultry feed trials complete. Algae strains produced for feed trials demonstrated high energy and protein content that were readily available, similar to other high value feed products used in the feeding of poultry today.

3 Major Milestone Goals for 2013-15

1. Completion of Phase III project co-located with Green Plains in Shenandoah, Iowa that we broke ground on in February 2012. Commercial operation planned for end of this year.
2. Continue construction of 200 acres of bioreactor system in Shenandoah, Iowa.
3. Continue roll-out of production platform co-located with teaming Green Plains
owned ethanol facilities, finalize design of first co-located bioreactor system in generation industry.

**Business Model** (e.g. owner-operator, technology licensor, fee-based industry supplier, investor): Owner-operator potentially followed by technology licensing, royalties and operational support to accelerate co-location roll-out.

**Competitive Edge(s):**
- Low Cost
- Scalable
- Co-location advantaged with all CO2 emitters

**Research, or Manufacturing Partnerships or Alliances.**
BioProcess Algae’s current joint venture partners provide strategic access to ethanol plants, existing infrastructure for downstream markets (e.g. fuel and feed) and process inputs (e.g. high quality CO2 and waste heat). Partner group possesses large scale manufacturing expertise as well as experience with rapid expansion in biofuel markets. BPA is also working with several academic institutions and industry groups to optimize products for downstream markets.

**Stage** (Bench, pilot, demonstration, commercial): Demonstration to Commercial

**Website URL:** www.bioprocessalgae.com

**Chief Executive Officer:** Tim Burns

**Business development or sales contact:**
Mike Melillo
phone: 401.683.5400
email: mikemelillo@bioprocessalgae.com

**Contact for follow up information:** (Name, title, phone, email)
Sasha Forsen
Public Relations Analyst
402.315.1670
Sasha.forsen@gpreinc.com
Project information: Shenandoah, Iowa

Materials or products produced
Flexible algae feedstocks for a variety of markets. We offer dried algae biomass or extracted oils for nutritionals, feeds and feed additives, chemicals and fuels.

Capacity (Millions of US gallons per years)

Year, month in service (planned or projected): 3 year

Status (Open, Under Construction, Planned): open, additional capacity being commissioned

Feedstock: Renewable CO2

Processing technology (e.g. advanced fermentation, enzymatic hydrolysis)
Low cost biofilm-based bioreactors for efficient conversion of CO2 and light into biomass and extracted oils for a variety of markets.
Bluefire Renewables

Based in:
31 Musick, Irvine, CA 92618

Year founded:
2006

Technology:
BlueFire Renewables’ own commercially ready, patented, and proven Concentrated Acid Hydrolysis Technology Process for the profitable conversion of cellulosic (“Green Waste”) waste material to ethanol, a viable alternative to gasoline.

Fuel type:
Ethanol

Major Investors
Quercus Trust owns approximately 20% of the company

Past milestones:
1. Received permits for Lancaster facility.
2. Teamed up with Solazyme
3. Deploying $40 MM award from U.S. Department of Energy to complete Mississippi facility
4. Changed name to BlueFire Renewables to reflect emphasis on chemicals and fuels.

Future milestones:
1. Construct and begin operation of Lancaster facility
2. Finance and construct Fulton, MS facility
3. Company to become profitable

Business model:
Owner/operator.

Fuel cost:
For the 1st facility, the fuel production cost will be approximately $1.60 a gallon. Fuel cost will be sub $1 a gallon on larger facilities.

Competitive edge:
BlueFire will locate its facilities near the end markets for the ethanol which gives it a competitive advantage over traditional ethanol production. BlueFire will also be able to produce at a lower cost by being located next to or in existing landfills, eliminating transportation cost.
Blue Marble Biomaterials

Address: #110, 410 Broadway E, Seattle, WA, 98102

Year founded  2007

Company description:
Blue Marble Biomaterials is developing sustainable systems to produce specialty biochemicals using waste plant material, such as beer mash and agricultural byproducts. Blue Marble's specialty biochemicals are zero-carbon, drop-in replacements to petrochemicals in everyday

Products: food, personal care and cosmetics. Not only can Blue Marble provide many replacements to these petrochemical products, we can do so in zero-waste, zero-carbon (or even carbon-negative) facilities. Specifically, Blue Marble produces carboxylic acids, esters, thiols and nitrogen compounds.

Our plant-fueled process taps into regional biomass waste streams and is adaptable to nearly any region. Because our system is feedstock agnostic, we can take any sort of cellulosic waste material. Ideally our regional biorefinery centers will also be where foodstuffs are produced, in order to minimize transportation impacts.

Major Investors: 100% private equity

Type of Technology(ies)
• Advanced fermentation for acids, esters and thiols
• Naturally hybridized bacteria (non-GMO)
• Supercritical extraction for oils, terpenes, and other molecules
• Algae-based water recycling systems
• Wet pyrolysis systems for solid waste reclamation

Feedstocks:
Blue Marble uses cellulosic, lignin, and protein byproducts of large-scale industries (e.g. brewing, forestry, food production, agriculture). Our system is feedstock agnostic, and is thus able to source the lowest-cost feedstock possible.

Products:
All of our products will be considered natural by the FDA, we are working with partners and customers for all of our products to be food grade.
• Carboxylic Acids: Butyric, Acetic, Formic, Propionic
• Esters: Methyl esters (methyl formate, methyl butyrate, methyl acetate, methyl
propionate), ethyl esters (ethyl formate, ethyl butyrate, ethyl acetate, ethyl propionate), propyl esters (propyl formate, propyl butyrate, propyl acetate, propyl propionate), butyl esters (butyl formate, butyl butyrate, butyl acetate, butyl propionate), and iso-butyl esters (iso-butyl formate, iso-butyl butyrate, iso-butyl acetate, iso-butyl propionate).

- Thiols: Methyl thioacetate, methyl thiobutyrate

**Product Cost** (if applicable - per US gallon):
Blue Marble’s is able to offer pricing that is competitive to current market prices on each compound offered. Even at a competitive market pricing, Blue Marble estimates gross margins to be over 70%. Our cost estimates include feedstock prices and cost of operations.
- Carboxylic Acids will be priced between $37.85 and $200 per gallon – depending on the particular acid.
- Esters will be priced between $49 and $215 per gallon – depending on particular ester.
- Thiols will be priced between $829 and $9,400 per gallon – depending on particular thiol.

(Costs per US gallon for fuels, costs per pound for chemicals and/or biomaterials. If you do not manufacture or have long-term stable feedstock pricing, please use the latest December futures contract pricing for traded feedstocks, or $55/ton for untraded biomass – or provide notes on your own feedstock pricing assumptions).

**Offtake partners** (if applicable)
- Sigma-Aldrich
- Major U.S. flavoring house (confidential)
- Major Swiss-based international flavoring house (confidential)

**Past Milestones**
- $3 million raised in private equity.
- Successfully completed demonstration-scale facility in Seattle, WA that processed 1 ton of feedstock per day.
- Commercial facility in Missoula, MT is operational. It is currently in the process of getting food grade and safety certifications to meet customer quality standards.

**Future Milestones**
- Sales to three of the top 10 international flavoring and fragrance houses.
- Expansion to $25 million large-scale facility. This facility will employ 80 full-time employees and use approximately 10,000 tons of feedstock per month.

**Business Model:** Owner-operator, technology licensor.

**Competitive Edge(s):**
- High Market Demand for **Products:** According to our industry partners there is a
high demand for natural esters, natural thiols and natural acids. Worldwide shortages of these products have increased the price and demand of these products so that any quality producer will be successful.

• **Sustainably Produced Products:** Our production process uses a wide variety of low-cost biomass byproducts from forestry and agriculture industries as feedstocks, and will eventually be powered primarily by methane generated by the process itself;

• **Feedstock:** We can use a wide variety of inexpensive and readily available feedstock, including agricultural, forestry and food wastes;

• **Low Cost of Production:** Our cost of production is much lower than costs involved with petrochemical refining in part due: low feedstock costs, efficient conversion rates, capital-light facilities, and water, heat and gas recycling technologies in our process.

• **Low Volume; Distributed Model:** We can site our production facilities at or near our customers’ facilities;

• **Margin Stability:** Our margins at scale are large enough to withstand extreme market volatility;

• **First Mover Advantage:** We will be the first company to develop specialty biochemicals for food and fragrance on a commercial scale; and

• **Proprietary Position:** BMBM has patents filed for its system processes. BMBM will maintain the intellectual property of its hybridized bacterial consortia in much the same way as Coca-Cola protects its formulas as a trade secret.

**Research, or Manufacturing Partnerships or Alliances.**

• AlgEvolve

• University of Montana

• University of Montana College of Technology

• Bionavitas

• Montana Department of Natural Resources & Conservation

• Major U.S.-based brewer (confidential)

**Stage:** Development

**Website URL:** www.bluemarblebio.com
Blue Sugars

Based in:
306 East Saint Joseph Street Suite 200, Rapid City, SD 57701

Year founded:
2003

Annual Revenues: – N/A

Technology Type: Thermal Mechanical

Fuel type: Cellulosic ethanol, lignin (including use as a high energy lignin pellet)

Major investors: Various strategic non-institutional investors.

Past milestones:
• a) Moving beyond our pilot plant to the opening in 2008 of the first USA based 2nd generation commercial scale demonstration plant producing cellulosic ethanol and high energy lignin and protein based co-products from forestry waste.
• b) Development of a commercially viable, “shovel-ready” technology, based on an environmentally friendly thermal-mechanical pretreatment and enzymatic hydrolysis process that works with various non-food feedstocks, including several types of woody biomass and bagasse. KL Energy has achieved or exceeded established industry benchmarks.
• c) Becoming a listed company and obtaining substantial investor funding over the last 14 months in an extremely difficult market, providing sufficient capital for development of technology into a commercially viable business model.

In August, KL Energy and Petrobras announced that they have entered into a Joint Development Agreement to jointly optimize BLUE SUGARS’s proprietary cellulosic ethanol process technology for sugarcane bagasse feedstock. As part of this agreement, The companies also said that they will develop a 4 Mgy bagasse-based cellulosic ethanol project that will be co-located with a Petrobras-owned sugarcane mill, which will come online in 2013.
In addition, Petrobras will provide $11 million to adapt BLUE SUGARS’s demonstration facility to the use of bagasse, validate the optimized process by producing cellulosic ethanol and lignin and license the validated technology.

The agreement has an initial term of 18 months and provides for mutual exclusivity in the area of developing cellulosic ethanol from bagasse. The latest generation of BLUE SUGARS’s process design provides for substantial enhancements over the first generation,
implemented in 2008 at the company’s demonstration plant in Upton, Wyoming using Ponderosa Pine feedstock, including the ability to be optimized for multiple feedstocks.

**Future Milestones:**

a) Commissioning and start-up of at least 5 currently identified cellulosic based energy projects with 100,000 to 200,000 metric ton processing capacity, over 3 continents by the middle of 2012.

b) Identifying and beginning construction on a minimum of 5 additional 100,000 to 200,000 metric ton cellulosic based energy projects by the end of 2013.

c) Formalizing national and international strategic partnerships and alliances that accelerate the commercialization of BLUE SUGARS technology, while proving and retaining a competitive edge in the industry.

**Business model:** Owner-operator and licensor-partner.

**Fuel cost:** Between $1.25 and $1.50 per gallon, before any federal or local incentives.

**Competitive edge:**

a. BLUE SUGARS’s technology is commercially viable today before the positive effects of federal and local incentives.

b. BLUE SUGARS’s commercially viable technology is capacity flexible, providing scalable, custom designed CBE plants tailored to the feedstock availability and the local market. Locating CBE’s near feedstock significantly reduces transportation costs.

c. BLUE SUGARS’s technology preserves the value of the co-products, resulting in optimum economic usage of the feedstock.

d. The co-products from the BLUE SUGARS technology, primarily lignin, have various valuable uses due to its high Btu content, including as a high energy lignin pellet.

e. BLUE SUGARS’s technology does not include gasification or substantive amounts of acid, resulting in lower capital costs, lower operating costs, and minimum fermentation toxicity, low water usage, resulting in an environmentally friendly process.

f. BLUE SUGARS’s technology results in high slurry concentrations, well above NREL heat material balance assumptions, resulting in substantially lower capital costs and operating costs.

g. BLUE SUGARS’s technology, while feedstock flexible, is very effective on various woody biomass and bagasse, feedstock available in plentiful supply in key markets throughout the world. The effective management of forests requires the management of woody biomass.

h. BLUE SUGARS’s alliances with investor partners provide valuable opportunities for future growth.

i. BLUE SUGARS’s experience with designing and operating highly efficient first generation ethanol plants provides significant competitive advantages for the implementation of BLUE SUGARS’s commercially viable technology.

j. As a result of lower capital costs, lower operating costs, and the valuable co-products, BLUE SUGARS is able to profitably scale down capacity levels substantially below competitors to serve specific local markets for feedstock and off-put products.

k. BLUE SUGARS’s investor partners, including those in the energy industry, are not a
limiting factor in the direction and scope of the company’s future operations and opportunities.

Alliances and Partnerships: BLUE SUGARS is in the process of formalizing several strategic alliances and partnerships. BLUE SUGARS’s investor partners’ experience and relationships in the energy industry have opened several opportunities for CBE projects, research and development, and distribution of ethanol and co-products, both nationally and internationally. Convinced by the results of BLUE SUGARS’s commercial scale demonstration plant, several 2nd generation enzyme and yeast producers partner with BLUE SUGARS for their testing on a commercial scale.

Development stage  KL Energy Corporation’s technology is commercially viable today, even before the substantial government incentives available.

Metrics: The commissioning and start-up of 10 profitable CBE plants by 2013.

Website: –www.bluesugars.com

Quotable- “From the beginning, we have focused on developing clean technology based on the economics of ethanol and high energy lignin by-products, including lignin pellets, from non-food feedstock. This focus has allowed us to become the first technology and commercially viable 2nd generation bio-fuel company that is ready to build profitable CBE’s today”.

“With our international investor partners and licensing agreements, we are able to rapidly implement our profitable business model throughout the world.
Borregaard Industries

Company description:
Biorefinery, main site in Sarpsborg, Norway. Production sites in South Africa, Brazil, USA and several countries in Europe.

Address (head office):
PO Box 162
NO-1701 Sarpsborg
NORWAY

Year founded:
1887

Major Investors (if a public company, please provide trading symbol and exchange).
Orkla ASA

Type of Processing Technology(ies) :

Products:
Lignin specialty chemicals, specialty cellulose, vanillin made from spruce, 20 mill liter 2-generation ethanol

Feedstocks:
Spruce, eucalyptus

Past Milestones
Have developed process and market for microfibrillar (nano) cellulose
Have developed process for production of lignin specialty chemicals and bioethanol from agricultural waste
Build and operate process steam plant for Sarpsborg Site fueled by municipal waste

Future Milestones
Build and commission microfibrillar cellulose Pilot Plant for Pharma and Food applications
Build and commission microfibrillar cellulose Pilot Plant for Industrial applications
Build and commission Pilot Plant for production of 2G bioethanol and lignin specialty chemicals from agricultural waste

Business Model:
Owner/operator

Competitive Edge(s):
Worldwide leader in lignin specialty chemicals, strong Innovation and R&D activity (60
researchers, 25 with a PhD)

**Distribution, Research, Marketing or Production Partnerships or Alliances.**
Major stakeholder in Project EuroBioRef (http://eurobioref.org/)

**Stage**
Commercial, but several new projects/products entering Pilot phase (see above)

**Website URL**
http://www.borregaard.com/
BP Biofuels

Address: 1 St James’s Square, London, SW1Y 4PD. UK.

Year founded

BP Biofuels was set up in 2006. BP p.l.c. celebrated its centenary in 2009.

Company description:
BP Biofuels is a leading global biofuels player, with a breadth of investment that is unique in terms of both its scale and its reach. Since 2006, BP has announced investments of more than $2 billion in biofuels research, development and operations, and has production facilities operating or in the planning/construction phases in the US, Brazil and Europe.

BP Biofuels has investments throughout the entire biofuels value chain: from sustainable feedstocks, including cellulosic energy grasses, through to advantaged molecules like biobutanol. BP’s close links into other sectors that will be crucial to the development of the biofuel industry, particularly the automotive industry, and its in-depth knowledge of the fuels market and infrastructure, will underpin the biofuels industry’s intentions to grow to be a more material and sustainable part of the global transport fuel market.

In Brazil, we have assets (BP-operated and joint venture assets) producing ethanol from sugar cane today. We were the first international oil company to invest in this industry. In the US, we are progressing the development of one of the US’s first commercial-scale cellulosic ethanol facilities, using proprietary technology, which will produce 36 million gallons of ethanol per year from energy grasses in Florida. We also have a demonstration facility, producing cellulosic ethanol in Louisiana and a purpose-built R&D facility in San Diego, California, where bioscientists are advancing the technology advancing the technology to commercialize cellulosic biofuels.

BP owns a large portfolio of intellectual property rights throughout the cellulosic biofuels value chain, encompassing proprietary conversion technology.

A BP joint venture, Butamax Advanced Biofuels, is developing the advanced biofuel biobutanol and commissioning a technology demonstration facility in the UK. Also in the UK, in partnership with AB Sugar and DuPont, BP is constructing a 110 million gallon per year wheat-to-ethanol facility. In addition, BP has invested $500 million over 10 years in the Energy Bioscience Institute (EBI), at which biotechnologists are investigating applications of biotechnology to energy.

BP is one of the world's largest energy companies, providing its customers with fuel for
transportation, energy for heat and light, retail services and petrochemicals products for everyday items. It is the largest oil and gas producer in the US and one of the largest refiners. BP also has a global network of around 22,000 service stations. BP blended and distributed more than 1 billion gallons of ethanol in 2008.

**Major Investors** (if a public company, please provide trading symbol and exchange).

BP is a public company, of which BP Biofuels is a wholly-owned subsidiary.
LSE (BP)
NYSE (BP)

**Type of Technology(ies)**
The BP Biofuels strategy focuses on the fermentation of sugars to produce ethanol, biobutanol and biodiesel.

**Feedstocks**
- Sugarcane
- Cellulosic feedstocks, on-purpose energy grasses
- Wheat

**Products** (e.g. ethanol, biobutanol, biodiesel, renewable diesel, renewable jet fuel, power, organic acids, bioplastics etc)

- BP is producing ethanol from sugar cane in Brazil at operated assets in Minas Gerais and Goias states and a joint venture in Goias.
- In partnership with DuPont (and via a joint venture Butamax Advanced Biofuels), we are developing the advanced fuel molecule biobutanol, which has a higher energy content that ethanol, can be blended at higher rates into fuel that can be used by vehicles on the road today and may be able to facilitate the adoption of biofuels into the fuel supply chain at a faster rate. The partners are constructing a technology demonstration facility in the UK.
- With AB Sugar and DuPont (through a joint venture called Vivergo Fuels), BP is constructing a 110 million gallon-per-year wheat to ethanol plant in the UK. When operating next year, it will produce one-third of the UK’s requirement for ethanol under the UK’s renewable transport fuel obligation (RTFO). Once the technology has been proven at scale, the partners will look to convert the plant to produce biobutanol.
- BP is collaborating with Martek Biosciences Corporation to advance technology for the conversion of sugars into biodiesel. The technology will convert sugars derived from biomass feedstocks (such as sugar cane or dedicated energy grasses) into diesel fuel molecules.
BP has committed $500 million over 10 years into the Energy Biosciences Institute – working with the University of California Berkeley and its partners, the University of Illinois, Urbana Champaign and the Lawrence Berkeley National Laboratory. The institute is exploring ways in which biosciences can be applied to produce new, cleaner energy fuels, including advanced biofuels.

BP is working with Mendel Biotechnology to develop a range of new energy grass feedstocks that can be used to produce the next generation of advanced cellulosic biofuels.

**Offtake partners** (if applicable)

Not applicable

**Past Milestones**

- Safe and reliable operations at operational facilities in Brazil
  - Industry leading safety performance. Recordable Injury Frequency rates have fallen from 5.5 (annual frequency per 200,000 hours worked) in December 2008 to 1.2 at the end of April 2011 – significantly lower than industry averages.
  - Above-expected production levels.
  - Acquired majority control of Brazilian sugar and ethanol producer CNAA in April 2011.

- Development of lignocellulosic biofuels:
  - Acquired biofuels operations from Verenium Corporation in 2010, including IP, R&D facility in San Diego and a demonstration facility in Louisiana. Also became 100% owners of commercial project in Florida.

- Sugar-to-diesel technology:
  - Joint development agreement (JDA) between BP and Martek Biosciences Corporation announced August 2009. JDA will establish proof of concept for large-scale, cost effective microbial biodiesel production through fermentation, from biomass feedstocks.

  Begin construction of one of the US’s first cellulosic ethanol facilities, in Highlands County, Florida.

**Future milestone**

With our JV partners:

- Demonstrate biobutanol technology and develop next steps for commercial deployment (with our partners DuPont, through our joint venture Butamax Advanced Biofuels).
- Progress development of sugar-to-diesel technologies in partnership with Martek Biosciences Corporation.
• Begin commercial production at world-scale wheat-ethanol facility in the UK (with our partners AB Sugar and DuPont, through our joint venture Vivergo Fuels).
• Begin commercial production at world-scale cellulosic ethanol facility in Florida (capacity 36 million gallons per year).
• Commercialize biobutanol technology (with our partners DuPont, through our joint venture Butamax Advanced Biofuels).

**Business Model:** (e.g. owner-operator, technology licensor, fee-based industry supplier, investor)

BP operates throughout the biofuel value chain. We own and operate facilities in Brazil and the US and have joint ventures and joint development partnerships in the Brazil, US and Europe where this gives us access to expertise in the technologies and markets required to ensure success. BP brings scale, infrastructure and fuels market knowledge to these partnerships to drive long-term development of the businesses.

**Competitive Edge(s):**

BP’s contribution to the biofuels industry is significant and growing. For our own biofuel operations, our differentiators are:
• Global scale and reach, and an intent to develop projects that can succeed on a global platform and make a material difference to supplies of sustainably-produced biofuels.
• Breadth of strategy – covering the entire biofuels value chain, from a range of sustainable feedstocks appropriate to different markets, through to the production of advantaged molecules to meet varied consumer needs: ethanol, biobutanol and biodiesel.
• As one of the world’s largest energy companies and a major blender, distributor and retailer of transport fuels, BP has core expertise and capabilities in fuel infrastructure, fuel markets and the requirements of the vehicle parc. This experience will be crucial in scaling up the biofuels supply chain to meet the needs of consumers.
• Sustainability has been central to the strategic decisions that BP has made about its biofuels business: the feedstocks to invest in, the geographies to focus on and the molecules to pursue. We are developing ways to ensure and report on sustainability throughout our supply chain – including the development of an effective sustainability management system for our biofuels operations and we are members of the Roundtable for Sustainable Biofuels, Bonsucro (formerly the Better Sugarcane Initiative), Roundtable for Sustainable Palm Oil and Roundtable for Responsible Soy.

**Research, or Manufacturing Partnerships or Alliances.**

• DuPont
• AB Sugar
• Mendel Biotechnology
• Martek Biosciences Corporation
• LDC Bioenergia
• Brazil Ecodiesel
• The Energy Biosciences Institute

Stage (Bench, pilot, demonstration, commercial)

• Commercial production of bioethanol from sugar cane in Brazil.
• Commercial production of bioethanol from wheat under construction in the UK.
• Demonstration scale LC ethanol and planned construction of commercial-scale facility in Florida.
• Biobutanol technology demonstration facility in commissioning phase in the UK.

Website URL

www.bp.com/biofuels
Ceres

Based in:
1535 Rancho Conejo Blvd., Thousand Oaks, CA 91320

Founded:
1996

Annual Revenues:
N/D

Type of technology:
Gene Marker-Assisted plant breeding, biotechnology and other genomics

Fuel Type:
Biomass is the common denominator to advanced biofuels, biopower and bioproducts and is independent of the end-fuel molecule.

Major investors:
Warburg Pincus, Warburg Pincus, Soros Private Equity Partners, GIMV, Oppenheimer.

Past milestones:
Completed IPO in 2012.

Launched commercial seed brand Blade Energy Crops, announced partnerships with leading biofuel and biopower companies.

Established world’s largest energy crop trialing network.

Ceres has opened a subsidiary to provide sweet sorghum for ethanol production. The company said that it is currently working with multiple ethanol mills, technology providers and equipment companies to facilitate the introduction of sweet sorghum hybrids into existing ethanol mills.

Ceres announced today that it has completed a private offering of convertible preferred stock. The proceeds will be used, in part, to expand the company’s research and commercialization activities in the advanced biofuels and biomass-to-power markets. The financing round was led by Artal Luxembourg and Ambergate Trust, and included European investment company Gimv, among others. Other aspects of the offering and its participants were not disclosed. Ceres currently markets improved seed varieties of switchgrass and high-biomass sorghum under its Blade Energy Crops brand, has additional research programs in sweet sorghum and miscanthus, and holds one of the world’s largest
proprietary collections of fully sequenced plant genes.

Ceres announced in July that it had developed a plant trait that could bring new life to millions of acres of abandoned or marginal cropland damaged by salts. Results in several crops, including switchgrass, have shown levels of salt tolerance not seen before. Ceres reported that its researchers tested the effects of very high salt concentrations and also seawater from the Pacific Ocean, which contains mixtures of salts in high-concentration, on improved energy grass varieties growing in its California greenhouses. According to Ceres, there are more than one billion acres of abandoned cropland globally that could benefit from this trait and others in Ceres’ pipeline, including 15 million acres of salt-affected soils in the U.S. The company now plans to evaluate energy crops with its proprietary salt-tolerant trait at field scale.

**Future milestones:**

Ongoing commercial sales and scale-up in pace with industry.

**Business model:**
Seed sales and trait licenses

**Fuel cost (per gallons)**
Yields per acre is one of the single largest levers against feedstock costs, which typically represents 50% of the cost of the finished product.

**Competitive edge:**
Genetics, Intellectual Property, Early Mover Advantage

**Distribution, research, marketing or production partnerships or alliances.**
R&D: Texas A&M (leading sorghum genetics), Samuel Noble Foundation (Switchgrass genetics) and other unannounced alliances in miscanthus.

**Development stage:**
Commercial

**URL:** [www.ceres.net](http://www.ceres.net) and [www.bladeenergy.com](http://www.bladeenergy.com)
Chemrec

Based in: Sweden, US subsidiary based in Illinois.

Year founded: 1989

Type of technology
The technology is gasification of black liquor for syngas generation followed by fuel synthesis. Black liquor is an abundantly available liquid biomass feedstock (600 TWh per year globally) with unique gasification properties allowing single step gasification to raw syngas of high quality (very low methane and tar content). In addition to supplying syngas the gasification process simultaneously provides chemicals recovery capacity for the host pulp mill cutting the effective investment cost significantly.

Type(s) of fuel
The type of fuel is flexible since the route is over syngas. Preferred fuels from a technical and economic standpoint are methanol and DME (dimethyl ether) which are the fuels produced with highest yield, energy efficiency and GHG emission reductions and with the lowest Product Cost on an energy content basis (regardless of which type of gasification front-end is included). In the extensive well-to-wheel joint study by the research institutes European auto industry (EUCAR), refinery industry (Concawe) and European Union (JRC), the combination of black liquor gasification and these fuel products were identified as the most energy-efficient and having the highest greenhouse gas emission reduction among the multitude of fuels studied.

Major investors
VantagePoint Venture Partners, Environmental Technologies Fund, Volvo Technology Transfer, Nykomb Synergetics

Past milestones:
  a) Created the BioDME consortium (Volvo Trucks, Total, Preem, Haldor Topsoe, Delphi, ETC and Chemrec) and completed financing for the BioDME technical demonstration project. The project includes development and production of heavy truck test fleet based on DME fuel, production of BioDME from black liquor derived syngas and putting in place of fuel distribution and filling stations. The production plant is located in Piteå, Sweden, project implementation activities well under way. Roll-out of first truck is in Sept 2009 and BioDME production will start July 2010.
  b) Created full-scale production plant concept for the Domsjö biorefinery and pre-qualified the project for $65 million investment grant from the Swedish Energy Agency. The plant will produce 95,000 tonnes per year of BioDME with the capability of also producing green methanol. Total investment cost is approx. $350
c) Accumulated operating time in the 20 tonnes dry solids per day DP-1 pressurized (30 bar, 450 psi), oxygen-blown development unit reached 10,000 hours in June 2009 consistently producing good quality syngas and recovered cooking chemicals. Scale-up activities for the 25 times larger commercial gasifier and gas cooling units are being essentially complete before end of 2009.

d) Launched pilot plant in Piteå.

Chemrec opened its pilot BioDME plant at the Smurfit Kappa paper mill in Piteå, Sweden. This pilot plant is part of the BioDME project where the production of BioDME and its use in heavy trucks is demonstrated. The syngas generation for the plant is based on Chemrec's black liquor gasification technology. The BioDME synthesis and upgrading technology is provided by Haldor Topsøe A/S. Other important components of the project are the distribution system and the vehicle test fleet.

Chemrec projects that up to one half of all heavy road transportation in Sweden could be run on BioDME, and that enough fuel can be produced from available black liquor feedstock, to supply the needs of one million heavy trucks. The company said that it is ready to start the Front-End Engineering and Design phase for its industrial scale plant at the Domsjö specialty cellulose mill in Örnsköldsvik, Sweden.

Future milestones:
Completing FEED and closing of financing for Domsjö project for start-up early 2013.
Develop additional projects in Europe and North America

Business model:
Project development, technology licensing and plant co-ownership.

Fuel cost:
Full fuel cost including capital cost as per RENEW project definition at $2 per gallon diesel equivalent ($1.5 per gallon ethanol equivalent) at the current US SE forest biomass price level. Generally, to get comparable and realistic answers to this question a standardized calculation model is required. There have been many grossly misleading statements on fuel cost circulating, especially in the US, where the numbers have been based on assumptions of negative feedstock costs or unrealistically low capital costs.

Competitive edge:
Well-developed technology with tens of thousands of operating hours in commercial first-generation plants and extensive relatively large-scale pilot tests for pressurized, oxygen-blown. Fuels synthesis is using fully commercial technology from the petrochemicals industry. BioDME plant under erection.
Well-documented low **Product Cost** and high GHG reduction (approx. 94%) as documented in open studies by e.g. Princeton university, EUCAR/Concafe/JRC and RENEW.

The technology will enhance value of existing assets and safeguard existing jobs in the pulp and paper industry while investment and operating costs are reduced by shared functions.

**Distribution, research, marketing or production partnerships or alliances.**  
BioDME Consortium for realizing the BioDME project  
Haldor-Topsøe, technology cooperation  
Alstom, development agreement

**Development stage:**  
• Demo for motor fuels units  
• Commercial for first generation air-blown gasifiers

**URL:** [www.chemrec.se](http://www.chemrec.se)
Chemtex / Beta Renewables

Company description:
Chemtex is a technology oriented global engineering company with strong process and R&D competencies and is part of a Group with 70 years of excellence in manufacturing. We deliver project solutions for the renewables (biofuels and bio-based chemicals), fibers, petrochemical, energy and environmental industries internationally. Chemtex employs approximately 1000 staff located in key centers throughout the world – Tortona and Rivalta in Italy, Wilmington, NC and Sharon Center, OH in the USA, Shanghai and Beijing in China and Mumbai, Bangalore and Baroda in India.

Chemtex is a full service project solution provider that offers state-of-the-art technologies (licensed and own), technology development (from its R&D facilities in the USA and Italy) and a complete range of project management, engineering, strategic sourcing and construction services for its clients throughout the world.

Address:
Italy Headquarters: Chemtex Italia S.r.l. Strada Ribrocca, 11 15057 Tortona (AL), Italy
USA Operations Center: Chemtex International Inc. 1979 Eastwood Road, Wilmington NC 28403

Year founded:
1958

Chief Executive Officer:
Guido Ghisolfi – CEO, Chemtex Group
Pedro Losa – CEO Chemtex International Inc.

Major Investors (if a public company, please provide trading symbol and exchange).

Gruppo Mossi & Ghisolfi (“M&G”) is presently the world’s largest producer of PET for packaging applications with 1.7 million ton of capacity annually. M&G is also a technological leader in the polyester market. Group sales proceeds in 2008 were almost $2.6B. The group has manufacturing assets in Brazil, Italy, Mexico and USA and supports three R&D facilities in Rivalta, Italy; Sharon Center, Ohio; and in Poços de Caldas, Brazil.

Type of Technology(ies)
Chemtex is actively involved in the bioethanol industry and has developed a game-changing second generation (2G) ligno-cellulosic ethanol technology.

Chemtex and its parent, Gruppo Mossi and Ghisolfi, have invested significant funds and have dedicated years of effort into the development of our PROESA ligno-cellulosic bioethanol technology. We have engineered and constructed a continuous
pilot facility in Rivalta, Italy where we have developed a unique bio-mass pretreatment and hydrolysis process, for which 11 patents applications have been filed, for transforming cellulosic feedstocks into sugar for conversion into ethanol and/or bio-based chemicals.

**Feedstocks:**

PROESA technology has the capability to use a wide variety of feedstocks. Successful testing has been completed for a number of different energy crops (Arundo Donax, Miscanthus, Fiber Sorghum and Switchgrass) and biomasses including corn stover, rice husk and straw (wheat and barley).

**Fuel Type:**

The PROESA platform includes an integrated solution for ethanol and power production. The sugars produced from the PROESA pretreatment and hydrolysis process can be also be converted to renewable diesel and a range of bio-based chemicals using the bio-technology of third parties.

**Fuel Cost (if applicable - per US gallon):**

Based on pilot plant results, and backed by extensive agronomic studies, the PROESA solution is expected to produce ethanol that is competitive to commercial grade fossil fuels based on an oil price of USD 50-70/bbl. For bio-based chemicals, the PROESA pretreatment technology is expected to be capable of producing fermentable sugars at approximately 50-60% of the cost of market sucrose.

**Offtake partners (if applicable)**

Not applicable.

**Co-products (if applicable)** The PROESA ethanol platform can also provide power, based on the burning of lignin, as a co-product for national grids.

3 Top Past Milestones

1. Successful start up of the PROESA pilot plant in June 2009 in Rivalta, Italy.
2. Successful continuous run - 30 days 24h/day - with straw and Arundo Donax in the spring of 2010.
3. Completion of the Basic Design package for the first 40,000 ton per annum PROESA Second Generation Demonstration Plant in Crescentino, Italy.

**Future Milestones**

1. Start up of the 20 million gallon PROESA Demonstration Plant in Crescentino, Italy in
2. Conversion of a first generation (1G) ethanol plant to utilize PROESA second generation (2G) technology in Crescentino by year end.
3. Start up of an integrated Biorefinery in the USA utilizing PROESA as the core technology.

**Business Model:**
Chemtex targets to provide full project solutions (license and EPC services) to both ethanol producers (existing or new) and bio-based chemical producers and/or their licensees.

**Competitive Edge(s):**

The PROESA solution is backed-up by extensive agronomic research into crop yields and crop management. Preferred biomasses (yielding up to 50 tons per hectare of usable feedstock on dry matter basis or 12 tons per hectare of ethanol) have been identified and tested and their associated logistic issues (harvesting, handling, etc.), are factored into the PROESAT solution.

Key features of the technology include:
- Although yields may slightly differ, PROESA Technology has the capability to use a large variety of biomass as collected (without further processing).
- A unique pre-treatment and hydrolysis process that produces a high yield of quality and low cost sugar from cellulosic biomass for conversion to ethanol and/or bio-based chemicals.
- High efficiency in viscosity reduction enzymatic hydrolysis.
- Simultaneous fermentation of C5 and C6 sugars.
- Energy integration with high efficiency burning of lignin.

The cost of the carbon feed is a most important driver in the economics of any biofuels/bio-based chemicals plant. Chemtex believes that its PROESA Technology is a “game-changer” as it requires no chemicals in the pre-treatment stage to generate good yields thereby resulting in a design that offers the lowest capex and opex when compared to alternative technologies. The PROESA solution is expected to produce ethanol that is competitive to commercial grade fossil fuels based on an oil price of USD 50-70/bbl. For bio-based chemicals, the PROESA pretreatment technology is expected to be capable of producing fermentable sugars at approximately 50-60% of the cost of market sucrose.

Chemtex is excited that this belief is shared by bio-tech companies such as Amyris who have entered into an agreement to integrate PROESA lignocellulosic technology into their platform to produce renewable fuels and chemicals.

**Distribution, Research, Marketing or Production Partnerships or Alliances.**

Chemtex will be the provider of the technology and will implement projects for interested
licensees of the technology.

Current alliances include Amyris with whom we have an agreement (through our parent) to integrate PROESA lignocellulosic technology into their platform to produce renewable fuels and chemicals.

Chemtex has also been awarded with substantial contributions (40 million USD) by European Institutions as co-sharing / support for the Research and Development program.

We are continuing to discuss other strategic partnerships and these will be announced once they have been concluded.

Stage:
A 40,000 ton per annum PROESA Demonstration Plant is under development with an anticipated start-up date of year end 2012.

Website URL:
www.chemtex.com
Clariant Produkte (Deutschland) GmbH

Address: Biotech & Renewables Center, Staffelseestr. 6, 81477 München, Germany

Year Founded: 1995

Annual Revenues: CHF 7.4 billion (2011)

Company description: Clariant is an internationally active specialty chemical company, based in Muttenz near Basel. The group owns over 100 companies worldwide and employed 22,149 employees on December 31, 2011. In the financial year 2011, Clariant produced a turnover of CHF 7.4 billion. Clariant is divided into eleven business units: Additives; Catalysis & Energy; Emulsions, Detergents & Intermediates; Functional Materials; Industrial & Consumer Specialties; Leather Services; Masterbatches; Oil & Mining Services; Paper Specialties; Pigments; Textile Chemicals.

Clariant focuses on creating value by investing in future profitable and sustainable growth, which is based on four strategic pillars: Improving profitability, innovation as well as research and development, dynamic growth in emerging markets, and optimizing the portfolio through complementary acquisitions or divestments.

The main focus of Clariant’s Biotech & Renewables Center is on bio-catalysis and bio-refining. The company develops energy-efficient processes for the manufacture of biomass-based chemicals and fuels. Clariant has developed the sunliquid technology which uses enzymatic hydrolysis followed by fermentation to produce second generation cellulosic bio-ethanol from wheat straw or other agricultural residues.

Milestones
The sunliquid process has been developed by Clariant since 2006. Since 2009 the company has successfully been testing the technology in pilot scale. In July 2012, Clariant has started operating a demonstration plant for the sustainable and economic production of cellulosic ethanol via its sunliquid process. The plant has a capacity of 1000 tons of ethanol per year and processes about 4500 tons of wheat straw or other agricultural residues. This plant constitutes the last step before the realization of large scale industrial plants which are aimed for in 2014/2015.

Business Model: The business model is to license the technology to interested parties. The sunliquid® process is intended for all those clients interested in one-stop licensing of an uncomplicated, full-scale turnkey process for the economic production of cellulosic ethanol. This is not limited solely to a customized concept for a turnkey plant. Clariant also supplies all the components required for cost-effective operation of the production
plant, including for instance starter cultures for producing enzymes and ethanol, as well as a special technology for energy efficient ethanol separation.

**Competitive Edge(s):** The sunliquid® process for cellulosic ethanol matches the ambitious targets for economically and ecologically sustainable production and greenhouse gas reduction. It was developed using an integrated design concept. Highly optimized, feedstock and process specific biocatalysts and microorganisms ensure a highly efficient process with improved yields and feedstock-driven production costs. Integrated, on-site enzyme production further reduces production costs substantially and assures independence from external suppliers. Simultaneous C5 and C6 fermentation increases ethanol yields by 50%. A proprietary and innovative ethanol separation method cuts energy demand by up to 50% compared to standard distillation. Thus, the energy derived from the byproducts like lignin and fermentation meet the entire electricity and heat demand of the production process, leading to close to 100% GHG reductions of the resulting ethanol.

**Stage** demonstration

**Website URL:** www.sunliquid.com

**Chief Executive Officer:** Dr. Hariolf Kottmann

**Business development or sales contact:** Martin Mitchell, sunliquid@clariant.com

**Project information**

**Location:** Straubing, Germany

**Materials or products produced:** cellulosic ethanol

**Capacity (Millions of US gallons per years):** 335,000

**Year, month in service (planned or projected):** 2012, July

**Status:** (Open, Under Construction, Planned): open

**Feedstock:** agricultural residues (corn stover, wheat straw, bagasse)

**Processing technology (e.g. advanced fermentation, enzymatic hydrolysis):** entire process for cellulosic ethanol production, including pre-treatment, enzymatic hydrolysis, integrated enzyme production, fermentation and ethanol separation
Cobalt Technologies

Address: 500 Clyde Avenue Mountain View, CA 94043

Year founded 2006

Annual Revenues: pre-revenue

Company description: Cobalt Technologies is commercializing cellulosic biobutanol, a versatile platform molecule for the renewable chemicals and fuels. The Company’s technology efficiently converts diverse non-food feedstocks - initially, lignocellulosic extracts from woody biomass and sugar cane bagasse - into biobutanol. Cobalt will offer complete systems for sugar mill, pulp and paper, and biomass power facility retrofits with a cost-effective biorefinery module, taking advantage of benefits of co-location (feedstock supply, logistics, permits) while enhancing overall facility returns. Feedstock for the biorefinery will be low-value hemicellulose and cellulose extracted from bagasse or woody biomass, and other available low-cost feedstocks.

Biobutanol can be used as is in paints, coatings and other chemical products, a 1.2 billion gallon, $7 billion global market. It can also be converted via known chemistry into a wide range of high value products, including 1-butene, isobutene and butyraldehyde derivatives, replacing petrochemicals and accessing a 67 billion gallon, $300 billion market, and full performance jet fuel and diesel. Biobutanol can also be blended with gasoline, diesel and ethanol to reduce emissions.

Engineered to achieve low costs through high productivity, energy efficiency and the use of low-cost feedstock, Cobalt is making biobutanol and its derivatives a cost effective substitute to petroleum-based materials.

Major Investors (if a public company, please provide trading symbol and exchange).
Pinnacle Ventures
Malaysian Life Sciences Capital Fund
VantagePoint Capital Partners
The Whittemore Collection Ltd.
Life Sciences Partners (LSP)
@Ventures
Burrill and Company.
Harris & Harris

Type of Technology(ies):
• Lignocellulose extraction and conditioning, depending upon particular feedstock
• Development of high performing organisms via proprietary techniques
• Accelerated fermentation in patent-pending bioreactor system
• Standard distillation technology optimized for unique attributes of Cobalt process
**Feedstocks:** Lignocellulose extracts from woody biomass in connection with pulp and paper or biomass power operations, sugar cane bagasse, and energy crops. Also other low cost sugars derived from wastes from industrial processes.

**Products:** Cellulosic n-butanol and derivative products

**Product Cost** (if applicable - per US gallon): (Costs per US gallon for fuels, costs per pound for chemicals and/or biomaterials. If you do not manufacture or have long-term stable feedstock pricing, please use the latest December futures contract pricing for traded feedstocks, or $55/ton for untraded biomass – or provide notes on your own feedstock pricing assumptions).

$1.70 - $2.50 per gallon, assuming $55 / ton of feedstock, and depending on specific feedstock and degree of pretreatment required to extract fermentable sugars.

**Offtake partners** (if applicable): under negotiation

**Past Milestones**
- Pilot plant opening in Mountain View in January 2010 – now over 8,300 hours of operations
- Agreement with U.S. Navy to produce full performance jet fuel (November 2010) and production of initial samples (July 2011)

**Future Milestones**
- Enter into commercial partnerships for feedstock supply, plant construction and offtake
- Build and commence operations of first commercial plant

**Business Model:** (e.g. owner-operator, technology licensor, fee-based industry supplier, investor): Joint venture partner contributing technology for equity participation plus cash investment where required for financing (i.e, first commercial plant) and as balance sheet permits.

**Competitive Edge(s):**
- Proprietary assays for development and selection of high performance non-GMO organisms
- Ability of proprietary organism to convert C5 sugars to solvent, which creates opportunities to use low cost feedstock.
- Bioreactor design that enables high levels of productivity (keeping capital costs low)
- Energy-efficient distillation process
- High value product (butanol price in chemical market is $6 per gallon)
Research, or Manufacturing Partnerships or Alliances.
US Navy
Colorado State University
Fluor Corporation

Stage (Bench, pilot, demonstration, commercial)
Pilot, currently designing demonstration.

Website URL: www.cobalttech.com
Codexis, Inc.

Address:
200 Penobscot Drive
Redwood City, CA 94063

Year founded 2002


Company description: Codexis serves major worldwide markets where clean technology can make a positive economic and environmental impact. Codexis CodeEvolver™ directed evolution technology accelerates development of high value sustainable products. Our focus is on the cost-effective conversion of renewable resources into transportation fuels, pharmaceuticals and biobased chemicals, and on the development of new technologies for effective air and water treatment.

Major Investors (if a public company, please provide trading symbol and exchange).

CDXS; NasdaqGS

Type of Technology(ies):

Directed evolution - CodeEvolver™ directed evolution technology
DNA shuffling
Synthetic biology/Systems biology
Multiplexed gene SOEing
Bioinformatics
Green chemistry

Feedstocks:

All – Codexis’ technology is feedstock agnostic.

Products (e.g. ethanol, biobutanol, biodiesel, renewable diesel, renewable jet fuel, power, organic acids, bioplastics etc)

Ethanol and Cellulosic ethanol

Product Cost (if applicable - per US gallon): (Costs per US gallon for fuels, costs per pound for chemicals and/or biomaterials. If you do not manufacture or have long-term stable feedstock pricing, please use the latest December futures contract pricing for traded feedstocks, or $55/ton for untraded biomass – or provide notes on your own feedstock
pricing assumptions).

N/A

Offtake partners (if applicable)

N/A

Past Milestones

Completed IPO April 2010
Received EPA Presidential Green Chemistry Award with Merck
Initiated detergent alcohol product line and completed cellulose enzyme scaleup 2011
Negotiated worldwide (ex. Brazil) rights and Shell royalty agreement to commercialize cellulase enzymes

Future Milestones

Commercialize detergent alcohol product line
Establish significant commercial presence in Brazilian fuels and chemicals markets

Competitive Edge(s):

There are a few things that make Codexis a formidable competitor in the biofuels industry:

- Codexis’ CodeEvolver™ directed evolution technology platform which combines sophisticated DNA shuffling and proprietary bioinformatics with advanced systems biology and nearly a decade of research experience to create “super” biocatalysts that are “custom fit” to solve complex bioindustrial problems. The Codexis CodeEvolver™ technology has been shown to reduce manufacturing costs, improve yield and reduce environmental waste in multiple applications in the pharmaceutical industry and is now under development for us in the advanced biofuels, biobased chemicals and carbon capture markets. Future applications include new methods of cost-effective wastewater treatment.

- Codexis’ role in Raizen, Shell’s $12 billion joint venture with Cosan - Shell has contributed its 16% ownership stake in Codexis to the joint venture company, Raizen, with the goal of developing and commercializing next-generation biofuels.

Stage (Bench, pilot, demonstration, commercial) Development

Website URL:
http://www.codexis.com/
Comet Biorefining

Based in: - 737 Guildwood Boulevard, London, Ontario N6H 5G2
Year founded - 2009

Type of technology
Pretreatment; Comet Biorefining has developed a transformative technology to produce cellulosic sugar from biomass for the production of biofuels and bioproducts.

Products
Comet’s cellulosic sugar can be used to produce any biologically derived fuel, including ethanol, butanol, synthetic hydrocarbons, algal fuels.

Major investors
Internally funded

Past milestones
- Proof of concept at lab/pilot scale
- Patents filed
- Co-location site for demonstration facility identified

Future milestones
- Financing
- Construct/optimize demonstration facility and design commercial system
- Establish downstream partnerships and licensees

Business model
License cellulosic sugar production technology; royalty-based payments

Competitive advantage
Low cost sugar; as low as 7 cents/lb

Stage
Pilot stage

Url
www.cometbiorefining.com
Coskata, Inc.

Address: 4575 Weaver Parkway, Suite 100, Warrenville, Illinois 60555

Year Founded: 2006

Annual Revenues: N/A

Company description:

Coskata is a technology leader in the production of alternative fuels and chemicals. Our proprietary process has been demonstrated at significant scale and offers:

- High yields
- Low costs
- Feedstock flexibility

While our technology platform is capable of producing multiple fuels and chemicals from a diverse array of feedstocks, we are initially focused on commercializing our natural gas conversion process. Natural gas is an attractive feedstock due to its abundant supply and low cost, and we expect to achieve production costs that are significantly lower than competitive approaches to fuels and chemicals production.

Major Investors (if a public company, please provide trading symbol and exchange).
General Motors, Total, Khosla Ventures, Blackstone Group, Advanced Technology Ventures, GreatPoint Ventures, Coghill Capital Management, TriplePoint Capital, Globespan Capital Partners, Arancia Industrial, Sumitomo.

3 Top Milestones for 2009-12

1. In the summer of 2012, Coskata announced its plans to switch its feedstock focus to natural gas at its first commercial facility. We achieve two major benefits from our move to natural gas: 1) we can achieve superior economics due to natural gas’ abundant supply and historically low price leading not only to favorable economics for the company, but also for consumers; and 2) the capital requirements for a natural gas commercial-scale facility will be significantly less since we do not have to budget for biomass handling or gasification.

2. In October 2011, Coskata announced that we had demonstrated two years of successful operation at our Semi-Commercial Facility, producing ethanol from both biomass feedstocks and natural gas.

3. In August 2011, Coskata completed our first close of Series D financing, with all major
investors from previous rounds participating.

3 Major Milestone Goals for 2013-15

1. Complete financing for first commercial facility.
2. Broker feedstock and offtake partnerships for commercial facility.
3. Complete construction of first commercial scale natural gas-to-ethanol facility

**Business Model:** (e.g. owner-operator, technology licensor, fee-based industry supplier, investor)

Owner-operator and technology licensor

**Competitive Edge(s):**

Coskata's technology platform offers industry-leading feedstock flexibility, allowing the company to utilize the most cost advantaged domestic feedstock available today, natural gas. Virtually any carbon-containing input materials can be converted to syngas, including natural gas, wood, municipal solid waste, agriculture residues, coal and industrial gases.

With natural gas prices of $4/mmBtu, we expect to achieve unsubsidized production costs well below that of current transportation fuels such as gasoline, diesel and corn-based ethanol. In fact, even if natural gas prices were to increase to 4 times today’s levels, we would still be competitive with current corn ethanol production costs.

By utilizing natural gas as a feedstock, not only can we produce transportation fuels at a price that creates value for consumers, we can also build much larger plants, because we will not be limited by availability of biomass within a specific radius. By producing at industrial scale, we can have a material impact on transportation fuel supply in this country.

**Research, or Manufacturing Partnerships or Alliances.**

Coskata is a member of the Renewable Fuels Association, the Advanced Ethanol Council, the Advanced Biofuels Association, and the Biotechnology Industry Organization.

**Stage** (Bench, pilot, demonstration, commercial)

Coskata unveiled its demonstration scale, integrated biorefinery facility in 2009, and is currently focused on financing and constructing a full-scale, natural gas to ethanol commercial facility.

**Website URL:**
www.Coskata.com

Chief Executive Officer:
William Roe

Business development or sales contact:
Rich Troyer, Chief Business Officer

Project information

Location: City, state
Madison, Pennsylvania

Materials or products produced
Ethanol

Capacity (Millions of US gallons per years)

Year, month in service (planned or projected)
Operation began in October of 2009.

Status: (Open, Under Construction, Planned)
Operated from October 2009 until the Fall of 2011 (over 15,000 operating hours)

Feedstock:
Natural gas, wood chips, and simulated waste materials

Processing technology (e.g. advanced fermentation, enzymatic hydrolysis)
Syngas fermentation (involving syngas production, fermentation and separation)
Direvo Industrial Biotechnology

Address: Nattermannallee 1, 50982 Cologne, Germany

Year Founded: 2008

Annual Revenues: 2.0 M Euro

Company description:
At Direvo, we focus on the emerging biomass conversion industry. We identify bottlenecks and weaknesses in current industrial processes in this sector. We develop biology-based solutions and implement those for our partners and customers, which include industrial companies both large and small.

Major Investors (if a public company, please provide trading symbol and exchange).
TVM Capital,
NRW Bank
Woelbern Invest

3 Top Milestones for 2009-11
- implementation of product development strategy
- build technical platform for our products BluZ-D and BluCon-P
- get a US team in place

3 Major Milestone Goals for 2013-15
- finalize BluZy-D development, launch product in the US
- reduce BluCon-P ethanol cost to parity with $100 barrel crude
- demonstrate lignocellulose to lactate conversion at pilot scale

Business Model: (e.g. owner-operator, technology licensor, fee-based industry supplier, investor)

Competitive Edge(s):
Direvo deploys its groundbreaking technology platform on the huge opportunity currently being presented by the clean energy, clean chemistry and biomass conversion industries. We apply our profound expertise in bioengineering to provide tailor-made, biology-based solutions for partners in several sectors of the biomass conversion industry.

Research, or Manufacturing Partnerships or Alliances.
- Iowa State University
- UoG

Stage (Bench, pilot, demonstration, commercial)
BluZy-D: demonstration
BluCon-P: bench

Website URL: www.direvo.com

Chief Executive Officer: Jorg Riesmeier

Business development or sales contact:
Greg Keeley in Boulder, CO
Klaudija Milos in Cologne, Germany
Albrecht Laeufer in Cologne, Germany

Project information

BluZy-D

Location: Cologne, Germany and Boulder, CO

Materials or products produced
Direvo uses its proprietary technology to provide a biological solution to the grain-to-ethanol industry leading to value-enhanced DDGS (dried distillers grains and solubles). This offers a clear win for both the ethanol plant and the animal producer.

- Superior DDGS quality: Enables high inclusion rates in poultry feed
- Improved economics: Superior DDGS has a higher market value than standard DDGS
- No capital expense: Easy implementation in existing processes
- Process stability: Production efficiency can be improved, for example by dewatering, oil separation or evaporation

Capacity (Millions of US gallons per years)  n/a

Year, month in service (planned or projected) n/a

Status: (Open, Under Construction, Planned) n/a

Feedstock: DDGS

Product Brand Name: BluZy-D

Product Description: BluZy-D is a proprietary enzyme product applied to the fermentation products of the standard dry mill ethanol process. A typical by-product of this process is
DDGS, which has become a widely accepted ingredient in livestock and poultry feed. However, the potential value of DDGS in animal feed has not been fully realized due to a variety of reasons. BluZy-D increases the nutritional quality of DDGS and establishes greater access for DDGS to the poultry and hog feed markets.

**Product Applications:**
The BluZy-D enzyme blend is directly added after fermentation without disturbing the process itself or any needed for additional capital expenditures. Through the action of our proprietary enzymes components are removed or modified. Thereby, we improve the nutritional quality of DDGS within the process with no hassle to the producer.

**Unique Features** (i.e., what separates this product from the competition, whether bio-based or incumbent fossil-based products – e.g. cost, performance features).
BluZy-D is the only product being applied directly to the grain-to-ethanol process resulting in superior DDGS nutritional quality.

**Head of sales**
Greg Keeley

**Project information:** BluCon-P

**Location:** Cologne, Germany

**Materials or products produced**
Direvo uses its proprietary technology and rigorous screening methods to create optimal bacteria, which in turn produce the lowest-cost biofuels and chemicals from a broad variety of non-food biomass inputs.
Currently, we are focusing on the production of ethanol and lactate

- Low capital expense: simple consolidated process in one vessel
- Low operating expense: Direvo’s bacteria contain all the enzymes needed for the conversion of lignocellulose to the desired end products
- Feedstock-agnostic: Direvo’s bacteria efficiently convert agricultural residues, energy crops and hardwood
- Robust, reliable process: fermentation occurs at above 70 degrees celsius

**Capacity (Millions of US gallons per years)** n/a

**Year, month in service (planned or projected)** n/a

**Status:** (Open, Under Construction, Planned)
open

**Feedstock:**
Grasses, e.g. straw, stover, miscanthus, switchgrass, bagasse

Processing technology (e.g. advanced fermentation, enzymatic hydrolysis)

Project notes, if any

EPC partner, if any

Product information: Product Brand Name: BluCon-P

Product Description:
BluCon-P is a portfolio of robust extremophile bacteria capable of fermentation at above 70 degrees C. The BluCon-P bacteria accept diverse sources of pretreated biomass including hardwood, grasses, bagasse and corn cobs. Ethanol and lactate are the primary products. Direvo is improving the competitiveness of its process in three key areas that will allow it to improve BluCon-P to the point where the cost of ethanol is comparable to that of fossil fuel. These areas are metabolic engineering, by which genes in the bacteria are knocked out in order to focus production on the desired end products; process optimization to improve yield; and strain optimization to make the bacteria optimally robust in their industrial environment.

Product Applications:
Currently, we are focusing on the conversion of grasses to either ethanol or lactate. The BluCon-P portfolio will soon also be capable of converting biomass to hydrogen and organic acids.

Unique Features
The Direvo BluCon-P consolidated bioprocessing approach reduces all relevant process steps for production of fuels and chemicals from pretreated biomass into a single fermentation tank. Enzyme production, cellulose and hemicellulose breakdown as well as conversion of both C6- and C5- sugars, all within one unit operation, make BluCon-P a highly promising approach to overcoming the pitfalls of second generation biofuel commercialization. The high process temperature eliminates contamination risk and enables in-situ capture of volatile products.

Head of sales,
Albrecht Laeufer
Diversified Energy

Based in: 2020 W. Guadalupe Road, Suite 5 Gilbert, AZ 85295

Founded: 2005

2009 annual revenues (projected) = $500k
2008 annual revenues = $500k

Business:
Diversified Energy Corporation is a renewable and alternative energy technology development and commercialization company. The strategy of the company is to maintain a diverse portfolio of technologies in the gasification and biofuels markets. As such, the company is developing (1) an innovative molten-slag based gasifier [OmniGas™] that can gasify a wide range of feedstock and produce an ultra-clean syngas, (2) a biorefinery technology to covert non-food based oils to petroleum-equivalent transportation fuels using little net hydrogen [Centia™], (3) a glycerol burner for the production of heat and/or power using raw crude glycerol from transesterification-based biodiesel production, and (4) a low cost algal biomass production system [Simgae™]. The company has been the recipient of numerous government grants and private investment to develop and ultimately commercialize these technologies.

Technology:
From OmniGas™ – syngas and/or various outputs from the further processing of the syngas (e.g., natural gas, FT diesel, methanol, ethanol, chemicals, and electricity) From Centia™ – biojet fuel, renewable diesel, and biogasoline all similar to petroleum-derived fuels
From glycerol burner – heat and/or power
From Simgae™ – algal biomass, lipids, nutraceuticals, and animal/fish feed

Investors
W. David Thompson (founder) and private individuals. Company is privately held and funded, no venture capital or institutional funding.

Past milestones:
a) Capture of multiple Small Business Innovative Research (SBIR) contracts from the DOE and DoD to develop the OmniGas™ molten-slag gasifier at a scale of 1 ton/day, as well as a R&D grant award from the California Energy Commission.
b) Successful production of sample batches of renewable diesel from Centia™ biorefinery process under a grant from the state of North Carolina.
c) Successful fabrication and operation of a 90k Btu/hr crude glycerol burner prototype, including testing for emissions and use of glycerol from operational biodiesel plants.

Future milestones
a) Successful demonstration of OmniGas™ reactor at 1 ton/day, construction start for full-scale, commercial equivalent pilot-plant facility.
b) Design, integration and demonstration of a 20–50 gallon/day Centia™ system taking multiple inputs (algal oils, jatropha oils, and animal fats) and producing biogasoline and biojet fuel with little net hydrogen consumption.
c) Scale-up of crude glycerol burner to 2 MW class, first commercial orders received.

Business model
Diversified Energy has a business model that is capable of reacting to the market environment and the situation at hand. The company requires additional capitalization to complete the development and commercialization of its technologies. Dependent upon the source of that funding, the company is open to sublicensing its technologies, forming JVs, spinning out the IP into new entities, selling its IP, building and selling plants, and/or building and operating plants.

Fuel cost:
OmniGas™ syngas estimate is $4.00 - $6.00/MMBtu. Centia™ estimate is <$0.40/gallon plus the cost of the incoming feedstock.

Competitive edge:
Diversified Energy’s competitive advantage is in its suite of innovative technologies, all of which have a common set of powerful, value-added attributes including: 1) technologies that can accept multiple incoming feedstocks, 2) technologies that can produce fuels that look akin to fossil-fuel based products, and 3) technologies that can economically scale to various sizes and thus bring distributed applications in close proximity to feedstock sources and energy distribution nodes.

Stage:
Pilot

URL:
www.diversified-energy.com
Drystills

COMPANY INFORMATION

Based in:
3549 Mavis Road Mississauga  L5C 1T7 Ontario Canada
Year founded: 2006

Type of technologies

Drystill is a Canadian developer and supplier of chemical separation technology. The company has developed a ground-breaking process - perhaps the only economical one at present - for refining cellulosic and corn ethanol from weak beers in the 3-8 wt% ethanol range. This is a strategic breakthrough for the Biofuel industry that will lead to a paradigm shift in the way ethanol is produced in the future.

At the heart of Drystill's technology is a proprietary, novel, apparatus called a Stripper/Absorption Module ("SAM") - the first of its kind in the World. This key technology enables Drystill to apply advanced, processing techniques, such as: simultaneous fermentation and extraction ("SFE"); low temperature, vacuum evaporation; and multiple-effect distillation ("MED") of beers.

The benefits of Drystill's technology to the Biofuel industry are significant, reducing both operating and capital costs. For example:

SFE allows practical, continuous fermentation, using weak beers. Production is therefore faster (residence time is reduced by 85%), yeast is potentially less stressed and less prone to infection, and more productive. At the same time, consumption of yeast is lowered.

The beer column is replaced by a MED device that does not suffer from fouling at high temperatures.

Consumption of energy during refining is reduced be 50% or more, e.g. to below 10,000 BTU/gal for an 8 wt% ethanol beer. Hypothetically, if all the plants in North America were using Drystill's technology, more than $2 billion p.a. in energy alone would be saved, or recovered by selling the surplus.

Capital expenditure is reduced by using smaller fermentation tanks (only 10% of size), cooling towers and steam plants, while beer columns and molecular sieves are replaced by less expensive and more efficient alternative equipment. In addition to the economic and technical benefits above, the environmental benefits are also very positive. Not only is energy consumption reduced substantially, but also the carbon footprint and water consumption. CO2 emissions are also reduced.
Simultaneous fermentation & extraction
Low temperature, vacuum evaporation
Multiple-effect distillation
Absorption/desorption
Pervaporation/vapour permeation
Solids handling

Type of fuel produced
Ethanol, butanol, other

Past milestones
Development of SFE technology
Provisional patenting of unique Stripper/Absorption Module ("SAM") – the key enabler of SFE and MED (see #5)
Establishment of relationships with seven large ethanol plant designers and owners

Future milestones
Attract a major investor
Construct a pilot/demonstration plant
Conclude a contract to install technology in a new plant, or retrofit an existing plant.

Business model
Licensing, component supply

Competitive edges(s)
Continuous ethanol extraction and fermentation
Faster processing with low residence times
Healthier & less stressful environment for yeast, leading to increased yield
Reduced refining energy consumption by 50% or more
Reduced capital expenditure
Smaller carbon footprint

Stage
Pilot/demo

Website URL
www.drystill.ca
DSM  
Unit: Bio-based Products & Services

Address:  
Visiting:  
Het Overloon 1  
6411 TE Heerlen  
THE NETHERLANDS

Mail:  
A. Fleminglaan 1  
2613 AX Delft  
THE NETHERLANDS

Year Founded:  
1902

Annual Revenues:
2009: 7,866 million EUR  
2010: 9,050 million EUR  
2011: 9,193 million EUR  
2012 Jan-Jun 4,558 million EUR

Company description:  
Royal DSM is a global science-based company active in health, nutrition and materials. By connecting its unique competences in Life Sciences and Materials Sciences DSM is driving economic prosperity, environmental progress and social advances to create sustainable value for all stakeholders. DSM delivers innovative solutions that nourish, protect and improve performance in global markets such as food and dietary supplements, personal care, feed, pharmaceuticals, medical devices, automotive, paints, electrical and electronics, life protection, alternative energy and bio-based materials. DSM’s 22,000 employees deliver annual net sales of about €9 billion.

DSM is a frontrunner in creating bio-based and environmentally sound solutions within its Bio-based Products and Services unit. DSM focuses on enabling technology in biofuels and bio-based chemicals and materials made from renewable biomass, and demonstrating the commercial viability of these technologies in collaboration with strategic partners along the value chain.

Major Investors (if a public company, please provide trading symbol and exchange).  
DSM is a publicly listed company at the NYSE Euronext Stock Exchange in Amsterdam, The Netherlands (ticker symbol DSM KON).

3 Top Milestones for 2009-11
2009: as a partner in the KACELLE consortium led by DONG Energy, DSM received a 1.1 M EUR grant from the European Commission (Framework Program 7) for the development of advanced ethanol yeast. This yeast has the potential to improve the economic viability of a wheat straw based biorefinery. Reference: http://www.inbicon.com/Projects/KACELLE

2010: DSM announces breakthroughs in enzyme and advanced yeast technology for conversion of ligno-cellulosic feedstocks into ethanol.

2010: DSM and Roquette Frères announce joint venture agreement for the production, commercialization and market development of bio-based succinic acid.

2011: DSM strengthens its leadership position in advanced yeast and enzyme technologies for cellulosic biofuels by the acquisition of C5 Yeast Company from Royal Cosun, becoming the first industrial biotechnology company to offer both enzyme and yeast fermentation technologies.

3 Major Milestone Goals for 2013-15
2012: Royal DSM, the global Life Sciences and Materials Sciences company, and POET, LLC, one of the world’s largest ethanol producers, join forces to commercially demonstrate and license cellulosic bio-ethanol.

2012 - Q4: technical completion & start up bio-succinic acid plant Reverdia in Cassano, Italy

2013: Start-up of Project Liberty, POET-DSM Advanced Biofuels’ plant in Emmetsburg, IA (U.S.A.)

2014: First sales of technology licenses by joint ventures POET-DSM Advanced Biofuels and Reverdia.

Business Model: (e.g. owner-operator, technology licensor, fee-based industry supplier, investor)
DSM focuses on enabling technology in biofuels and bio-based chemicals and materials made from renewable biomass, and demonstrating the commercial viability of these technologies in collaboration with strategic partners along the value chain. Primarily, we see our future in the development and supply of high value knowledge, ingredients and expertise in the field of bio-conversion technology – licensed out to bio-based entrepreneurs, to access and convert biomass in the most commercial and sustainable ways possible, rather than as an owner/operator of manufacturing facilities.

Competitive Edge(s):
• DSM is the first to offer both enzyme and yeast solutions for ethanol production from
ligno-cellulosic feedstock, with a >100 year track record in biotechnology and chemo-catalytic routes

- DSM is an early mover in this industry, prepared to take entrepreneurial risk
- DSM is focused on food/feed, as well as on fuel/energy/chemicals

**Research, or Manufacturing Partnerships or Alliances.**
- With Roquette Frères (France) in JV Reverdia® for development and production of Succinic Acid, and licensing technology thereof
- With POET(Sioux Falls, SD) in POET-DSM Advanced Biofuels for development and production of cellulosic ethanol, and licensing technology thereof
- With BP Biofuels: partnership to develop process for ‘sugar to diesel’ conversion technology (fermentative route).

**Stage** (Bench, pilot, demonstration, commercial)
All of the above

**Website URL:**
www.dsm.com

**Chief Executive Officer:**
CEO Royal DSM: Feike Sijbesma
President Bio-based Products & Services: Anton Robek

**Business development or sales contact:**
Bio-Energy: Steve Hartig
Bio-based Chemicals & Materials: Marcel Lubben
Dynamotive

Based in:
13091 Vanier Pl, Suite 140, Richmond, BC V6V 2J1

Year founded:
1991

Annual Revenues:
2009 [projected], 2008, 2007) 2009 (n/a) , 2008 ($178,106) , 2007 ($0)

Type of technology:
Fast Pyrolysis, Biomass Into GasOil (BINGO) thru Hydroleforming & Hydrotreating stages.

Fuel Type:
BioOil®, BioOil Plus®, CQuest™ Biochar, UBA, UBB

Past milestones:

• Renewable Gasoline and Diesel from Ligno-Cellulose Biomass Produced at Dynamotive's Research Facility in Ontario, Canada

Re: Analysis of Dynamotive Upgraded BioOil® Confirms Gasoline, Jet, Diesel and Vacuum Gasoil Fractions; Proprietary Two Stage Upgrading Process Provides Path to Mobile Fuels from Biomass

• BlueLeaf Inc. and Dynamotive Announce Biochar Test Results CQuest Biochar Enriched Plots Yield Crop Increase Ranging From Six to Seventeen Percent vs. Control Plots

• Dynamotive Receives $260,000 Order for West Lorne BioOil® - The order envisages a minimum of 18 shipments of BioOil®, August 3, 2009.

Future milestones:

• USDA – ARS Study Results (Impact of Biochar on Soil Quality, Crop Yields, Carbon Sequestration, and Water Quality), Late 2009 – Early 2010. Additional tests with BlueLeaf Inc.

• Pilot Plant Completion, Upgrading BioOil thru BINGO process. Third party testing/verification of fuel.
• Announcement of first U.S. project site for BioOil Upgrading plant (commercial/demonstration).

**Business Model:**
Licensing, Research & Development, Owner/Operator.

**Fuel Cost:**
BioOil®: Fuel #2 BTU equivalent less 10%
CQuest™ Biochar: Market value currently being developed thru independent trials
UBA/UBB:

**Competitive Edge:**

• Food vs. Fuel: The Company converts residual biomass from agricultural and forestry operations and/or dedicated non-food crops through a thermochemical process into BioOil and Biochar. BioOil and Biochar plants can coexist with existing forestry and agricultural facilities, providing an additional benefit to operations.

• Yield: Dynamotive’s pyrolysis process converts roughly 85% of the total biomass feed into useful solid (char) and liquid (BioOil) fuels. The balance is utilized to provide energy to the process.

• Yields of Diesel/Gasoline from BioOil through the Stage 2 (hydrotreating) upgrading process of 37% have been achieved at bench-scale. The net overall yield from whole biomass to diesel/gasoline is approximately 25%, which to our knowledge is the highest ever reported.

• Scale: Dynamotive’s process is projected to be economically viable at 1/7 to 1/15 scale of competing technologies currently known or under development. It is projected that a plant processing under 70,000 tonnes of biomass a year would produce approximately 4,500,000 gallons of renewablegas-oil at under $ 2 per gallon. The scale factor enables distributed production i.e. plants can be developed in diverse locations creating sustainable “green” jobs, while being compatible with agro and forestry operations.

• Flexibility: the two stage process developed by the Company also allows for the opportunity to further upgrade the stage 1 renewable gasoil into diesel and gasoline fuels at a centralized facility or the development of a fully integrated plant if production logistics and economics merit it. This provides for flexibility in development and application.

• Investment: Given the plant scale, the investment required is comparatively low. Approximately $ 33 million will deliver a 15 year production capacity of approximately 67 million gallons of renewable transportation grade hydrocarbon fuels. This is a fraction of the capital cost per gallon and per plant required by proposed competing technologies.
• Time to market; Dynamotive’s pyrolysis platform is available today, with plants of 130 Mt and 200 Mt per day completed. The upgrading process uses conventional hydrotreatment equipment and process conditions allowing for rapid implementation at pilot and commercial scale.

**Distribution, research, marketing or production partnerships or alliances?**

Tecna S.A. (strategic engineering partner), Renewable Oil Corporation (Australia)

**Development stage:**

Pyrolysis technology platform available commercially today, Upgrading BioOil thru BINGO process (bench-scale), pilot plant planned for 2010.

**Website**

www.dynamotive.com/
Dyadic International, Inc.

Company description:

Dyadic International, Inc. is a global biotechnology company that uses its patented and proprietary technologies to conduct research, development and commercial activities for the discovery, development, manufacture and sale of products and solutions for the bioenergy, industrial enzyme and biopharmaceutical industries.

Address:

140 Intracoastal Pointe Drive
Suite 404
Jupiter, Florida 33477

Year founded:

1979

Major Investors (if a public company, please provide trading symbol and exchange).

Pink Sheets: DYAI

Type of Technology(ies)

Patented and proprietary C1 platform technology based on a unique fungal microorganism which is programmable and scalable in producing enzymes and proteins in large quantities

Feedstocks:

Dyadic’s C1 platform technology is effective in producing enzymes from a broad variety of feedstocks

Fuel Type (if applicable): (e.g. ethanol, biobutanol, biodiesel, renewable diesel, renewable jet fuel, power etc)

Dyadic’s C1 platform technology can be used to produce many types of biofuels including, but not limited to, cellulosic ethanol, biobutanol and biodiesel.

Fuel Cost (if applicable - per US gallon):

N/A
Offtake partners

- Abengoa Bioenergy
- Codexis Inc.

Co-products (if applicable)

Industrial Enzymes

3 Top Milestones for 2010-12

1. Entered into non-exclusive license agreement with Abengoa Bioenergy
2. Reported record revenues and profits for fiscal year 2009
3. Signed term sheet for potential exclusive outlicense of C1 technology for biopharmaceutical applications to EnGen Bio, Inc.

3 Major Milestone Goals for 2013-15

1. Consummate additional licensing and other strategic collaborations to monetize Dyadic’s technologies
2. Increase sales of industrial enzymes
3. Consummate additional research and development collaborations

Business Model: (e.g. owner-operator, technology licensor, fee-based industry supplier, investor)

- Technology licensor
- Industrial enzyme sales

Competitive Edge(s):

- Patented and proprietary C1 technology
- C1 platform technology is programmable (genome has been sequenced and annotated)
- C1 technology can produce enzymes and proteins on commercial scale (up to 150,000 liter fermentors)
- Dyadic provides partners with ability to license the C1 platform technology for in-house/on-site manufacturing of customized enzymes and proteins

Distribution, Research, Marketing or Production Partnerships or Alliances.

- Non-Exclusive License Agreement with Codexis Inc. for use of C1 technology for biofuels, chemicals and pharmaceutical intermediate production
- Non-Exclusive License Agreement with Abengoa Bioenergy New Technologies, Inc.
for use of C1 technology for biofuels, chemicals and/or power production
• Non-binding term sheet with EnGen Bio, Inc. for potential outlicense of C1
technology for biopharmaceutical applications
• Multiple research partnerships

Stage:

Dyadic has been producing enzymes in up to 150,000 liter fermentors for over a decade
Demonstration and soon-to-be commercial stage through Dyadic’s licensees and partners

Website URL

www.dyadic.com
Dynamic Fuels

Based in: Louisiana

Business:
Dynamic Fuels is a 50/50 venture between Syntroleum and Tyson Foods. Develops process for converting low value and waste fatty acid/glyceride streams (from spent vegetable oils used in food processing to palm oil fatty acid distillate) into high quality hydrocarbon fuels (diesel, jet fuel, naphtha, and LPG).

Model:
50/50 venture between Syntroleum and Tyson Foods. Dynamic Fuels’ business model is “own and operate” bio-refineries based on Syntroleum’s Bio-Synfining process.

Past milestones:
Dynamic Fuels has spent all of the past year staffing up and building a 75 million gal/yr plant in Geismar, LA (near Baton Rouge). This will be the first “second generation” biofuels plant in the U.S.-converting non-food biofeeds into drop-in hydrocarbon fuels.

Future milestones:
Commercial production is scheduled to begin during first quarter of 2010.

URL:
www.dynamicfuelsllc.com
Edeniq, Inc.

Address: 2505 N. Shirk Road, Visalia, CA  93291

Year Founded: 2008

Annual Revenues: Not Disclosed

Company description:

Edeniq integrates patented mechanical and biological processes to efficiently and cost-effectively break down plant material into sugars that become sustainable fuels and/or industrial materials. Edeniq’s patent portfolio includes innovation in biological catalysts plus mechanical processes that help meet the industry-wide challenge of taking today’s plant-based resources into future markets and applications.

Major Investors (if a public company, please provide trading symbol and exchange).

Blue Sugarsiner Perkins Caufield & Byers
Draper Fisher Jurvetson
The Westly Group
Angeleno Group
Cyrus Capital
Morgan Stanley
Element Partners
Flint Hills Resources
I2BF

3 Top Milestones for 2009-11

DOE funded biorefinery retrofit, allowing our existing pilot plant to be upgraded to a larger, continuous operating unit. DOE fully funded their $20M portion in Feb 2011 after we passed their engineering review. Retrofit completed and plant commissioned in 1H 2012. Technology showcased at this plant is the integration of our biological and mechanical solution, converting non-food biomass into low cost sugars and ethanol. The plant is called our CCM plant, named for our Corn – to – Cellulosic Migration strategy.

Commercialization of our biomass particle sizing units (the Cellunators), which are up and running at three large US based corn ethanol plants, providing over 3% yield improvements to the plants.

Product development of Edeniq Enzyme solution, named Pathway™, which provides corn ethanol plants a drop in solution to produce cellulosic ethanol at their plant from the corn
bran/pericarp. The drop in solution consists of using Edeniq’s Cellunator particle sizing milling unit along with Edeniq’s proprietary Pathway™ enzyme solution.

3 Major Milestone Goals for 2013-15

Operations of our, DOE backed, 50,000 GPY pilot scale biorefinery in 2012-2013, including running multiple cellulosic (non food) feedstocks through the plant to showcase our economical conversion rates into cellulosic sugars and ethanol.

Commercial sales and installation of our Pathway product (drop in corn cellulosic ethanol solution which allows the corn bran/pericarp to convert into ethanol, thereby providing cellulosic ethanol) at current corn-based ethanol plants. Continue our work with EPA for qualified advanced fuel RINs credits on this product line.

Scale up of our high purity, cellulosic feedstock based sugars. The scale up will be in both the US and Brazil locations, converting corn stover and bagasse, respectively, into high purity sugars that will be sold as an intermediate to advanced fuel and renewable chemical producers.

Business Model: (e.g. owner-operator, technology licensor, fee-based industry supplier, investor)

Due to our broad industry experience at Edeniq, along with our base of investors and strategic partners, we have business strategy that may include all of the above business models.

Competitive Edge(s):

Broad Market Applicability: Low-cost sugars (from corn, cellulosic or other feedstocks) feed into a variety of possible revenue streams and result in more economically-competitive products.

Open-System Plant Partnerships: Our business model allows for close collaboration with existing producers (in the US, Brazil and ROW) and those migrating to next-generation production.

Mechanical and Biological Integration: Our patented combination of proprietary machines and enzymes brings cutting-edge research and development to existing facilities. Today, we have bolt-on technologies and retrofits that improve existing biofuel facilities and boost profitability.
Research, or Manufacturing Partnerships or Alliances.

Worldwide exclusive license to Cellunator biomass milling machine (OEM is IKA Works).

Licensed biologics technology from USDA Forest Products Laboratory.

Department of Energy program is funding $20M of a $25M retrofit of Edeniq’s existing cellulosic ethanol pilot plant.

Current investors and Flint Hills Resources (largest division of Koch Industries) just put in equity in a Series B2 and Series C round, which closed in Q2 2012.

California Energy Commission (CEC) added a nearly $4 million grant to focus our CCM (corn to cellulosic migration) strategy on California based agricultural waste feedstocks; along with funds to perform feasibility studies to commercialize the technology at the California corn ethanol plants.

Stage  (Bench, pilot, demonstration, commercial)

We have operated a pilot scale plant, running batch runs through the plant for almost 6 years. After the launch of our retrofitted pilot plant in 1H 2012, we now have the ability to run up to 2 tons of biomass through a day continuously. The total annual capacity for this retrofitted plant will be up to 50,000 gallons per year.

Website URL:  www.edeniq.com

Chief Executive Officer:

Brian Thome

Business development or sales contact:

Steve Rust, Vice President, Sales and Marketing
Peter Kilner, Vice President, Business Development

Project information: CCM Pilot Biorefinery

Location: City, state

Visalia, California

Materials or products produced
Cellulosic Sugars and Ethanol

Capacity (Millions of US gallons per years)

50,000 GPY

Year, month in service  (planned or projected)

Plant has been in service since March 2012

Status: (Open, Under Construction, Planned)

Open

Feedstock:

Corn stover
Switchgrass
Sugarcane bagasse
Wood fiber

Processing technology (e.g. advanced fermentation, enzymatic hydrolysis)
Mechanical pretreatment (Cellunator)
Advanced C5/C6 yeasts
Advanced enzymes (Pathway)
Advanced corn oil extraction (OilPlus)
Combination of saccharification and fermentation
SmartFlow Technology for water and lignin recovery

Project notes, if any

Logos Technologies is the prime contractor on the DOE project with contributed $20.5 million to the pilot plant retrofit.
Product information: Cellunator

Product Description:
Proprietary bolt-on mixing and particle sizing milling device

Product Applications:
Installed and running at three Edeniq customer facilities, as well as showcased at Edeniq’s pilot biorefinery facility located at Visalia headquarters

Unique Features (i.e., what separates this product from the competition, whether bio-based or incumbent fossil-based products – e.g. cost, performance features).

Pretreatment of corn and cellulosic biomass increases conversion efficiency of starch and cellulose by increasing surface area of particles and making particle sizes uniform. Delivers low-cost, high-quality sugars for ethanol and other bio-based materials production

Feedstocks and bio-based content (e.g. “20% soy-based”)
Mills a variety of feedstocks such as corn, sugarcane bagasse, woodchips, corn stover, switchgrass, sugarcane

Wholesale or retail Product price: (if applicable) Not disclosed.

Parity price, e.g. competitive with $XX oil: (if applicable, in BPOE, US$) Not disclosed.

Website URL: www.edeniq.com

Product photo URL: (if available)

Head of sales
Steve Rust, Vice President, Sales and Marketing

Contact for follow up information:
Scott Janssen, CFO: 559-302-1779,

Product Brand Name: OilPlus

Product Description: Proprietary bolt-on corn oil extraction unit and process
Product Applications: Releases oil from corn ethanol process, allowing it to be sold as a value add by product.

Unique Features (i.e., what separates this product from the competition, whether bio-based or incumbent fossil-based products – e.g. cost, performance features).

Proprietary bolt-on oil recovery process increase corn oil extraction, adding value

Feedstocks and bio-based content (e.g. “20% soy-based”)

Corn

Wholesale or retail Product price: (if applicable)
Not Disclosed.

Parity price, e.g. competitive with $XX oil: (if applicable, in BPOE, US$)
Not Disclosed.

Website URL: www.edeniq.com

Product photo URL: (if available)

Head of sales,

Steve Rust, Vice President, Sales and Marketing

Product Brand Name: Pathway enzymes

Product Description:

Process of integrating enzymes with mechanical platform to deliver even greater productivity

Product Applications:
Pathway enzymes, in combination with our Cellunator allow for conversion of cellulosic component of biomass into sugars and ethanol. Initial application is in corn ethanol plants, allowing the Cellunator and Pathway enzyme to convert the cellulosic component of corn into sugars and ethanol inside of the existing plant.

Unique Features (i.e., what separates this product from the competition, whether bio-based or incumbent fossil-based products – e.g. cost, performance features).
Our Pathway integrated enzymatic and mechanical platform is specially formulated for specific feedstocks

**Feedstocks and bio-based content** (*e.g. “20% soy-based”*)

Can be used with a variety of feedstocks such as corn, sugarcane bagasse, woodchips, corn stover, switchgrass, sugarcane

**Wholesale or retail Product price: (if applicable)**
Not Disclosed.

**Parity price, e.g. competitive with $XX oil: (if applicable, in BPOE, US$)**
Not Disclosed.

**Website URL:** www.edeniq.com

**Product photo URL:** (if available)

**Head of sales,**

Steve Rust, Vice President, Sales and Marketing
Elevance Renewable Sciences Inc.

Address: 2501 Davey Road, Woodridge IL 60517

Year Founded: 2007

Annual Revenues: privately held; detailed revenues are not disclosed but between $20-50 million

Company description: Headquartered in Woodridge, Illinois, Elevance Renewable Sciences, Inc. creates valued specialty chemicals from natural oils. Using a technology called olefin metathesis, the company creates high performance ingredients for use in personal care products, detergents, fuels, lubricants and other specialty chemicals markets.

Major Investors (if a public company, please provide trading symbol and exchange). Investors in Elevance include TPG Growth, TPG Biotechnology, Naxos Capital Partners and Total Energy Ventures International, Lacustrine Limited via Genting Genomics Limited, wholly owned by Genting Berhad Cargill, Inc. and Materia, Inc.

3 Top Milestones for 2009-11
2009
1. Elevance Renewable Sciences Announces $1 Million Partnership With Trent University Biocomposites Research Laboratories
2. Elevance Renewable Sciences Receives Biorefinery Grant From the U.S. Department of Energy
3. Elevance Receives SaskCanola Research Grant to Enhance Use of Canola Oil in Developing Renewable-Based Chemicals

2010
1. Elevance Renewable Sciences Announces Joint Venture With Wilmar International To Build World Scale Biochemical Refinery
2. Elevance Enters Joint Development Agreement with Stepan to Commercialize Novel Surfactants & Antimicrobials
3. Elevance Renewable Sciences Raises $100 Million in Series C Financing

2011
1. Elevance Renewable Sciences Broadens Technology Portfolio to Include Additional Metathesis Catalysts, Secures Licensing Agreement with XiMo
2. Elevance Renewable Sciences announces acquisition of Delta BioFuels facility in Natchez, MS
3. Elevance Renewable Sciences Raises $104 Million in Series E Financing
3 Major Milestone Goals for 2013-15

1. Completion of construction and commencing commercial sales from World Scale Biochemical Refinery
2. Commercialization of additional novel products from our various collaborations: Stepan, Clariant, others
3. Completion of engineering and commencing construction on our facility in Natchez, MS to convert it into our 2nd biorefinery

Business Model: (e.g. owner-operator, technology licensor, fee-based industry supplier, investor) Producer and collaborative partner.

Elevance was created on the premise that a high performance, renewable, capital light, partnership-based business model will provide a unique market position based on a significant and sustainable advantage in the specialty chemicals market. The company has achieved rapid growth as a result and continues to focus on establishing unique partnerships and collaborations. Elevance has established feedstock, technology and manufacturing as well as market partnerships, working with innovative industry leaders to accelerate the production and commercialization high performance renewable chemicals:

Competitive Edge(s):
By simultaneously producing a suite of high value chemicals and fuels from any of several different feedstocks, Elevance’s biorefinery has a distinct economic advantage over other processes, as demonstrated by its ability to be profitable without subsidies. Elevance has a strong intellectual property position, demonstrated by the Nobel Prize awarded to Dr. Robert Grubbs in 2005 for his work developing the core technology, metathesis, which Elevance uses. In addition to its large patent portfolio, Elevance has extensive proprietary knowledge, deep experience from our leadership team and employees and large, strong investors. Elevance’s business model of collaboration leverages the significant strengths of our partners, like Dow Corning and Wilmar International. Finally, the speed at which we have and are commercializing our business creates a significant advantage.

Research, or Manufacturing Partnerships or Alliances.

Elevance partnerships and alliances include:

• Arkema, France
• Clariant International Ltd, Germany
• Dow Corning Corporation, United States
• Saskatchewan Canola Development Commission (SaskCanola), Canada
• Stepan Chemical, United States
• Tetramer Technologies, LLC, United States
• Trent University, United States
• United Soybean Board (USB), United States
• United States Department of Energy, United States
• Wilmar International, Singapore
• XIMO AG, Switzerland

Stage (Bench, pilot, demonstration, commercial) The Elevance process is already commercial. The company has produced over 1.5 million pounds of product in tolling campaigns while construction has been underway on the worldscale Wilmar Elevance Biorefinery

Website URL: www.elevance.com

Chief Executive Officer: K’Lynne Johnson

Business development or sales contact: Andy Shafer

**Project information: Surabaya, Indonesia**

Materials or products produced The biorefinery will produce green olefins, including a unique distribution of alpha and internal olefins for chemicals and advanced fuels; novel multifunctional esters and acids, including 9-decenoic acid, as well as a premium mixture of oleochemicals and advanced biofuels

Capacity (Millions of US gallons per years) This commercial-scale manufacturing facility will begin with a capacity of 180kMT (approximately 400 million pounds) with the ability to expand up to 360kMT (approximately 800 million pounds) of products

Year, month in service (planned or projected) We are accepting customer orders now with supply commitments beginning mid 2012 once start-up activities are completed.

Status: (Open, Under Construction, Planned) Under construction

Feedstock: Flexible it will be capable of operating using multiple renewable oil feedstocks, such as palm, mustard, soybean, jatropha or waste oils, initially palm oil

Processing technology (e.g. advanced fermentation, enzymatic hydrolysis) The joint venture will use Elevance’s proprietary biorefinery technology. Elevance’s proprietary patent-protected technologies transform renewable plant-based oils into specialty, high performance green chemical products without the environmental risks of traditional petrochemical solutions. Elevance’s innovative technology is based on the work of Nobel Laureate Dr. Robert H. Grubbs, who pioneered the olefin metathesis catalyst development at The California Institute of Technology
Project information: Natchez, Mississippi

Materials or products produced  The biorefinery will produce green olefins, including a unique distribution of alpha and internal olefins for chemicals and advanced fuels; novel multifunctional esters and acids, including 9-decenoic acid, as well as a premium mixture of oleochemicals and advanced biofuels

Capacity (Millions of US gallons per years)  This commercial-scale manufacturing facility will begin with a capacity of approximately 270kMT (approximately 600 million pounds) of products. The company intends to convert the existing bio-diesel facility to a biorefinery and derivatives operation in a multi-phase project that will involve an investment of more than $225 million and will create 165 full-time jobs over the next five years, in addition to 300 construction jobs.

Year, month in service  (planned or projected) 2014

Status: (Open, Under Construction, Planned) Engineering underway

Feedstock: Flexible it will be capable of operating using multiple renewable oil feedstocks, such as palm, mustard, soybean, jatropha or waste oils, initially soy or canola oil

Processing technology (e.g. advanced fermentation, enzymatic hydrolysis)  The biorefinery will use Elevance’s proprietary technology. Elevance’s proprietary patent-protected technologies transform renewable plant-based oils into specialty, high performance green chemical products without the environmental risks of traditional petrochemical solutions. Elevance’s innovative technology is based on the work of Nobel Laureate Dr. Robert H. Grubbs, who pioneered the olefin metathesis catalyst development at The California Institute of Technology.

Project notes, if any

EPC partner, if any: Not currently disclosed

Product information

Product Description: Elevance’s extensive portfolio of high performance products are targeted at meeting customer needs in three large market platforms:

- **Consumer Ingredients and Intermediates**: NatureWax® and novel performance waxes, antimicrobials, ingredients for personal care products and intermediates for detergents, cleaners and other consumer products
- **Engineered Polymers and Coatings**: unique building blocks for creating high performance plastics and specialty coatings
• Lubricants, Fuels and Additives: high performance lubricant base oils, lubricant and fuel additives, and advanced biofuels

Product Applications: see above

Unique Features (i.e., what separates this product from the competition, whether bio-based or incumbent fossil-based products – e.g. cost, performance features). Elevance produces products that outperform traditional petrochemicals. For example, our products help lotions protect and moisturize the skin without feeling greasy; candles have lasting fragrance; or detergents clean better in cold water saving energy while using less detergent.

Feedstocks and bio-based content (e.g. “20% soy-based”) Elevance products are produced using multiple renewable oil feedstocks, such as palm, mustard, soybean, jatropha or waste oils, initially palm, soy or canola oil.

Wholesale or retail Product price: (if applicable) – not disclosed

Parity price, e.g. competitive with $XX oil: (if applicable, in BPOE, US$) highly competitive on a cost-performance basis

Website URL www.elevance.com

Product photo URL: (if available)

Head of sales, Andy Shafer, EVP Sale & Market Development
Enerkem

Address: 1130 Sherbrooke Street West, Suite 1500
Montreal, Quebec H3A 2M8, Canada

Year Founded: 2000

Annual Revenues: undisclosed – private company

Company description: Enerkem develops biofuels and chemicals from waste. With its proprietary thermochemical technology, Enerkem converts abundantly available municipal solid waste (mixed textiles, plastics, fibers, wood and other non-recyclable waste materials) into chemical-grade syngas, and then methanol, ethanol and other chemical intermediates that form everyday products. By using waste instead of fossil fuels, Enerkem addresses the growing demand for renewable energy sources and chemicals, while reducing landfill volumes and greenhouse gas emissions. Headquartered in Montreal, Canada, the company currently operates both a pilot and a demonstration facility in Quebec, has its first waste-to-biofuels full-scale commercial plant under construction in Edmonton, Alberta, and is developing similar facilities in Pontotoc, Mississippi and in Varennes, Quebec.

Major Investors (if a public company, please provide trading symbol and exchange).
Enerkem is a private company founded in 2000 by its current senior management. It is majority-owned by institutional, clean-technology and industrial investors, including Rho Ventures, Braemar Energy Ventures, Waste Management (NYSE:WM), Valero (NYSE: VLO), BDR Capital, Cycle Capital, The Westly Group, Fondaction CSN and Quince Associates, L.P.

3 Top Milestones for 2009-11

1. Commercial facility developments: Started construction of its first full-scale commercial plant in Edmonton, Alberta (Canada) and continued development of similar commercial projects in the U.S. and Canada including a facility in Pontotoc, Mississippi

2. Technological achievement and scale-up: Successful production of chemical-grade syngas and biomethanol at Enerkem’s demonstration facility in Westbury. These achievements further validated the company’s capability of producing a chemical-grade syngas from waste and converting it into alcohols using well-established catalytic reactions, as already proven at Enerkem’s pilot plant in Sherbrooke.
3. Financial support for growth: From 2009 to 2011, Enerkem has raised a total of US$160 million in financing, both at the corporate and project subsidiary levels. Waste Management and Valero joined as strategic investors in the company. Enerkem was also awarded financial support (cost-share program and loan guarantee) for a total of US$130 million from the U.S. Department of Energy (DOE) and the U.S. Department of Agriculture (USDA) for a U.S. plant in Mississippi.

3 Major Milestone Goals for 2013-15

1. Began ethanol production from waste at Westbury demonstration facility (in addition to the ethanol already produced at its pilot facility before) – announced June 7, 2012: [click here for news release]

2. Beginning of operations at Edmonton waste-to-biofuels facility – expected in 2013. Expected to ready the facility for methanol production in 2013 and then to convert it to produce ethanol from the methanol.

3. Construction of Varennes facility expected to begin by start of 2014 – project announced February 6, 2012: [click here for news release]

Business Model: (e.g. owner-operator, technology licensor, fee-based industry supplier, investor)

**Owner-operator / Technology licensor** – Enerkem is quickly moving towards commercialization with full-scale biofuels plants it will build, own and operate. Enerkem builds its facilities near the raw material supply sites, and uses the end waste that would otherwise be landfilled. The plants are compact, modular and scalable for ease of replication. They are based on a standardized system. In order to accelerate market penetration, Enerkem also plans to sell systems utilizing its proprietary technology platform to strategic partners in North America and internationally. It has entered into strategic development agreements with Waste Management and Valero.

**Competitive Edge(s):** Enerkem is uniquely positioned to recover the abundant supply of non-recyclable waste to profitably produce second-generation biofuels and green chemicals. Its waste-based biofuels provide one of the most advanced solutions to the growing world demand for renewable biofuels, while also addressing the challenges associated with waste disposal and GHG emissions.

The company today produces methanol and cellulosic ethanol from waste, using its proprietary thermochemical technology platform. Its Westbury demonstration facility is one of the largest
thermochemical facilities to process heterogeneous waste material as feedstock.

Enerkem is a leader in the advanced biofuels sector. Its full-scale commercial waste-to-biofuels facility currently under construction in Edmonton, Alberta, is part of the first wave of cellulosic biofuels projects in the world.

Enerkem’s business model and technology platform are expected to generate competitive production cost economics. Using MSW as a feedstock provides a cost advantage as the company is paid to use the material. With its modular, copy-exact and scalable approach, Enerkem is expected to further reduce operating and capital costs as it builds larger facilities and benefit from economies of scale and increased energy efficiency. Also, Enerkem’s proprietary thermochemical technology operates at low-severity conditions which significantly reduce operating and capital costs due to lower temperature, pressure and energy requirements.

The company also plans to continue to innovate and deploy new products: the chemical-grade syngas produced by Enerkem can be used to create chemical intermediates that form a wide range of everyday products, such as paints, coatings for textiles, and perfumes.

Research, or Manufacturing Partnerships or Alliances.

**R&D partnerships:**
- University of Sherbrooke
- Alberta Innovates
- U.S. National Renewable Energy Laboratory
- Natural Resources Canada

**Strategic partnerships:**
- Waste Management
- Valero Energy Corporation
- GreenField Ethanol

**Stage** (Bench, pilot, demonstration, commercial):

**Commercial** – It should be noted that Enerkem’s first full-scale commercial facility in Edmonton, AB (Canada) is currently under construction. Operations are expected to begin in 2013.
Website URL:  
www.enerkem.com

Location:      SHERBROOKE, QUEBEC, CANADA - Pilot plant and research center

Materials or products produced:  Small quantities of syngas, methanol, acetates and second-generation ethanol

Capacity (Millions of US gallons per years)  N/A

Year, month in service:  2003

Status: (Open, Under Construction, Planned):  Open

Feedstock:  To date, over 25 different types of feedstocks have been used to test and validate the technology, and for engineering design purposes. These feedstocks include municipal solid waste, wood chips, treated wood, sludge, petcoke, spent plastics and wheat straw.

Processing technology:  Thermochemical

Project notes, if any  N/A

EPC partner, if any  N/A

Westbury, Quebec, Canada - Demonstration facility

Materials or products produced:  Methanol and cellulosic ethanol

Capacity (Millions of US gallons per years)  1.3 million gallons per year (methanol)

Year, month in service  Operations started in 2009 (syngas), 2011 (methanol), 2012 (ethanol)

Status:  Open

Feedstock:  Used electricity poles, mixed waste

Processing technology:  Thermochemical

Project notes, if any  We believe that the Westbury facility is one of the largest thermochemical facilities to process heterogeneous waste
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<th>Full-scale commercial facility</th>
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<tr>
<td>Materials or products produced:</td>
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<td>Year, month in service</td>
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<td>Processing technology:</td>
<td>Thermochemical</td>
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<td>Project notes, if any</td>
<td>We believe the Edmonton facility is the first collaboration between a waste-to-biofuels company and a metropolitan center to address its waste disposal challenges.</td>
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<td>EPC partner, if any</td>
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<tr>
<td>Capacity (Millions of US gallons per years)</td>
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<td>Year, month in service</td>
<td>2015</td>
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<tr>
<td>Processing technology:</td>
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</tr>
<tr>
<td>Project notes, if any</td>
<td>Joint venture partnership (50/50) with one of the largest</td>
</tr>
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</table>
ethanol producers in Canada, namely GreenField Ethanol. The integration with a first-generation ethanol production facility will allow us to take advantage of certain existing infrastructure at the site (e.g. site roads, utilities and ethanol handling facilities).

EPC partner, if any

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Location: PONTOTOC, MISSISSIPPI - Full-scale commercial facility

Materials or products produced: Methanol and cellulosic ethanol

Capacity (Millions of US gallons per years) 10 MGPY

Year, month in service 2015

Status: Under development

Feedstock: Sorted municipal solid waste

Processing technology: Thermochemical

Project notes, if any This project has been selected to receive up to US$ 50 million from the U.S. Department of Energy (DOE), as well as a conditional commitment in January 2011 for an US $80 million loan guarantee by the U.S. Department of Agriculture (USDA). The project has successfully met federal environmental assessment requirements.

EPC partner, if any ~
Fulcrum BioEnergy, Inc.

Address:
4900 Hopyard Road Suite 200 Pleasanton, CA 94588

Year founded
2007

Company description:
We design, develop, own and will operate facilities that convert sorted, post-recycled municipal solid waste, or MSW, into ethanol. We have entered into long-term, fixed, zero-cost MSW feedstock agreements which will provide us with a significant competitive advantage over companies using alternative feedstocks for the production of biofuel. Our proprietary process, built around numerous commercial systems available today, has been tested, demonstrated and will be deployed on a commercial scale at facilities that we will build, own and operate.

Fulcrum is ready to begin construction on our first commercial scale project, the Sierra BioFuels Plant (Sierra) located approximately 20 miles east of Reno, Nevada.

Major Investors (if a public company, please provide trading symbol and exchange). Fulcrum is privately held and financed by US Renewables Group (USRG) and Rustic Canyon Partners (Rustic Canyon). USRG manages a portfolio of renewable power and clean-fuel assets, and Rustic Canyon is one of the largest venture capital firms based in Southern California.

Type of Technology(ies)
Fulcrum’s proprietary process converts MSW into ethanol. This process, built around numerous commercial systems available today, has been tested, demonstrated and will be deployed on a commercial scale at facilities that we will build, own and operate. We utilize sorted, post-recycled MSW and convert it into ethanol using a two-step thermochemical process that consists of gasification followed by alcohol synthesis.

Gasification System

Our gasification system is comprised of a down-draft partial oxidation gasifier, a Plasma Enhanced Melter (PEMTM) and a thermal residence chamber that we have purchased from InEnTec. Fulcrum’s first plant, Sierra, will utilize three trains of this gasification system to convert the organic material in the MSW feedstock to a syngas consisting primarily of carbon monoxide, hydrogen and carbon dioxide.

Alcohol Synthesis Process
Our proprietary alcohol synthesis process incorporates a catalyst that was developed and is owned by Nipawin and SRC. The Nipawin/SRC catalyst is very similar to hydrotreating catalyst used in almost every refinery in the world. The catalyst contains no precious or rare earth metals and can be recycled by the catalyst manufacturer.
Feedstocks:
Fulcrum’s feedstock will consist primarily of the organic material found in MSW, which is currently being landfilled.
Products (e.g. ethanol, biobutanol, biodiesel, renewable diesel, renewable jet fuel, power, organic acids, bioplastics etc) Although Fulcrum’s main product for Sierra will be ethanol, the catalyst and our proprietary alcohol synthesis process provide us with the flexibility to produce other alcohols, such as methanol and propanol.

Product Cost (if applicable - per US gallon): (Costs per US gallon for fuels, costs per pound for chemicals and/or biomaterials. If you do not manufacture or have long-term stable feedstock pricing, please use the latest December futures contract pricing for traded feedstocks, or $55/ton for untraded biomass – or provide notes on your own feedstock pricing assumptions).

Fulcrum believes we can produce advanced biofuel at a production cost of approximately $1.30 per gallon at Sierra, a substantially lower cost per gallon than traditional fuels and other renewable biofuels. We believe our production process will also generate sufficient electricity to operate our facilities, contributing to our lower production costs. The modular design of our technology will allow us to more efficiently construct future facilities with up to six times the production capacity of Sierra, which we believe will lower our production costs below $1.00 per gallon.

Offtake partners (if applicable)
Fulcrum has entered into a three-year off-take agreement with Tenaska BioFuels, LLC for the full output of Sierra.

Past Milestones
• Completed construction and began operations of our TurningPoint Ethanol Demonstration Plant to demonstrate our proprietary alcohol synthesis process utilizing a full-scale reactor identical to those that will be used at Sierra. To date, we have successfully operated the demonstration plant for more than 8,000 hours.
• Entered into an EPC contract with Fluor for Sierra. Continued development efforts with the project and progressed to detailed engineering, with construction beginning by the end of 2011.
• Raised the equity capital needed for the construction of Sierra ($86 million).

Future Milestones
• Complete construction and commence commercial operations of Sierra, our first waste-to-biofuels facility.
• Develop and bring to construction at least two additional, larger waste-to-biofuels facilities in the U.S.
• Continue development efforts on 15+ additional project
opportunities throughout U.S. when once completed, along with the other projects mentioned above, will produce more than 700 million gallons of advanced biofuels each year.

**Business Model:**

Developer/Owner/Operator

**Competitive Edge(s):**

Fulcrum’s production facilities will provide numerous social and environmental benefits. By providing a reliable source of domestic renewable transportation fuels, our facilities will be helping the United States reduce its dependence on foreign oil. In addition, we expect our process will reduce GHG emissions by more than 75% compared to traditional gasoline production.

Our process does not compete with recycling programs available today. We use MSW feedstock after it has been processed for recyclables, such as cans, bottles, plastic containers, paper and cardboard that would otherwise be landfilled. By diverting MSW from landfills, our facilities will help mitigate the need for new landfills and extend the life of existing landfills. Lastly, our MSW feedstock does not have the land use issues or adverse impact on food prices generally associated with other feedstocks used to produce ethanol, such as corn and sugarcane.

Other competitive strengths include:

- **Feedstock Economics:** We have entered into long-term, zero-cost contracts for enough MSW located throughout the United States to produce more than 700 million gallons of ethanol per year. Our stable cost structure, based on long-term zero-cost MSW feedstock arrangements, will allow us to enter into fixed-price off-take contracts or hedges to secure attractive unit economics.

- **Infrastructure:** By using MSW, we benefit from existing infrastructure for collection, hauling and handling. No new logistical networks would be required to transport the feedstock to our facilities.

- **Technology:** We have licensed and purchased the gasification system from a third party. Our alcohol synthesis process demonstration unit has operated at full scale for more than 8,000 hours. We have filed patent applications for the integration of the MSW to ethanol process.

- **Electrical Supply:** Our process will generate enough electricity to power our plants and reduce our reliance on external electricity sources. Research, or Manufacturing Partnerships or Alliances. Fulcrum has been successful in securing long-term, zero-cost MSW feedstock agreements with national, large solid waste companies to provide us with a reliable and abundant stream of MSW not only for Sierra BioFuels, but also for future projects that we expect to develop in locations throughout the United
States. Currently we have access to enough zero-cost MSW feedstock across 19 states to produce more than 700 million gallons of ethanol per year.

Stage (Bench, pilot, demonstration, commercial) Sierra will be a commercial-scale waste-to-biofuels facility. Construction is expected to begin by the end of 2011 with commercial operations commencing during the second half of 2013.

Website URL
www.fulcrum-bioenergy.com
Genera Energy

Company description:

Genera Energy is a for-profit limited liability company wholly owned by the University of Tennessee Research Foundation. Genera provides a vehicle to leverage state and federal funding with private research and development investments, strategic partnerships and collaborations to further research, economic development and clean energy objectives. Genera is focused on developing integrated biomass supply chain solutions and strategic partnerships to advance the bioenergy industry.

Genera’s portfolio of clean energy projects include:

- Contracting with farmers to produce 6,000 acres of switchgrass on privately owned farms in East Tennessee.
- Construction and operation of a demonstration-scale cellulosic ethanol biorefinery in Vonore, Tennessee. The biorefinery is operated in conjunction with DuPont Danisco Cellulosic Ethanol.
- Construction and operation of Tennessee’s Biomass Innovation Park, a research, demonstration and development campus in Vonore, Tennessee that focuses on purpose-grown energy crops and integrates the entire biomass supply chain in one location. The Biomass Innovation Park includes harvesting, handling, storage, densification, transportation, pre-processing and conversion.
- Partnership with an energy crop seed company.
- Establishment and management of the Tennessee Biomass Supply Cooperative, a new generation farmers’ cooperative.
- Genera Capital, a new subsidiary that is the venture funding arm of Genera Energy.

Address:
2450 EJ Chapman Drive, Suite 216, Knoxville, Tennessee 37996

Year founded:
2008

Annual Revenues:
Grants and contracts; minor switchgrass sales

Major Investors (if a public company, please provide trading symbol and exchange).
State of Tennessee

Type of Technology(ies)
- Integrated and comprehensive biomass to biofuels and bioproducts.
• Integrated switchgrass supply chain solutions (seeds, production, management, harvesting, storage, transportation, and pre-processing).

Feedstocks:
Switchgrass, woody biomass and other purpose-grown energy crops.

Fuel Type:
Cellulosic ethanol; biochemicals and bioproducts from lignin.

Offtake partners (if applicable)
Undisclosed

Co-products (if applicable)
Chemicals and products from lignin

Past Milestones
3. Formed the first value-added processing cooperative for biomass feedstock, the Tennessee Biomass Supply Cooperative.

Future Milestones
1. Production of cellulosic ethanol from switchgrass at Vonore biorefinery.
2. Completion of Biomass Innovation Park, in Tennessee and validation of regional aggregation depot business model for sustainable biomass supplies, co-product processing and pre-processing.
3. Use the Vonore biorefinery to demonstrate new improvement and optimization for commercial development.
4. Begin construction on the first commercial-scale switchgrass to ethanol biorefinery project in Tennessee.

Business Model: (e.g. owner-operator, technology licensor, fee-based industry supplier, investor)
• Biomass feedstock solution provider
• Technical Licensor
• Project Developer

Competitive Edge(s):
• Owner of the only demonstration-scale cellulosic ethanol biorefinery operating on multiple biomass feedstocks.
• Developer of unique Biomass Innovation Park that integrates and optimizes the entire biomass supply chain in one location, spanning from the field gate to the biorefinery gate, including biomass receiving, handling, convergence, storage, pre-
processing and densification.

- Partner with DuPont Danisco Cellulosic Ethanol. Affiliated with the University of Tennessee Institute of Agriculture, with access to license all clean energy Intellectual Property.
- Manager of unprecedented state funded Tennessee Biofuels Initiative.
- Partner with the nation’s largest State Farm Bureau.

**Distribution, Research, Marketing or Production Partnerships or Alliances.**

- Alliances – State of Tennessee, University of Tennessee, Tennessee Farm Bureau

**Stage** (Bench, pilot, demonstration, commercial)

Demonstration/Pilot; Pre-Commercial

**Website URL**

[www.generenergy.net](http://www.generenergy.net)
Genomatica

Address: 10520 Wateridge Circle San Diego, CA 92121

Year Founded: 2000

Annual Revenues: 2011: $4.3 million

Company description:
Genomatica is a technology leader for the chemical industry. It delivers new manufacturing processes that enable its partners to produce intermediate and basic chemicals from renewable feedstocks. These chemicals serve as the basis for making substantially all of the products that make modern life possible. Genomatica’s processes are designed to achieve better economics with enhanced sustainability and a smaller environmental footprint than petroleum-based manufacturing processes.

Genomatica is developing a pipeline of manufacturing processes for the production of major chemicals, starting with BDO (1,4-butanediol). The first commercial-scale BDO plant that uses Genomatica’s BDO process is expected to begin production in 2013, at a Novamont plant. Genomatica has announced that butadiene will be its second targeted commercial process, and Versalis and Novamont have joined its bio-butadiene program following the successful production of pound quantities from renewable sources.

Genomatica has intellectual property for over 20 major chemicals and has a distinctive technology platform, recognized by the distinguished EPA Presidential Green Chemistry Challenge award, that facilitates a productive approach to developing processes for additional chemical targets.

Genomatica’s strategy is to license its technology to major companies worldwide. By developing processes that produce the exact same chemicals used today in value chains, and working with and through partners, Genomatica believes that there is the potential for rapid industry adoption. This approach was recognized for its transformative potential by the previously-mentioned EPA award, the CONNECT Most Innovative Product award, and being named a finalist for two ICIS innovation awards, with final judging in process as of August 2012. Genomatica partners include Novamont, Mitsubishi, Versalis, Gruppo M&G, Waste Management and Tate & Lyle.

Major Investors (if a public company, please provide trading symbol and exchange).
Genomatica has raised $125 million from venture capital and strategic investors including Alloy Ventures, Bright Capital, Draper Fisher Jurvetson, Mitsubishi Chemical, Mohr Davidow Ventures, TPG Biotech, VantagePoint Capital Partners, Versalis and Waste Management.

Past Milestones
1. Validated Genomatica’s process for the production of BDO at demonstration scale
2. Signed first wave of strategic partnerships, with Tate & Lyle (demonstration-scale validation); Waste Management (joint development for syngas from waste as feedstock); M&G (PROESA biomass technology); Novamont and Mitsubishi (MOUs for BDO plants in Europe and Asia)

3. Produced pounds of bio-based butadiene

**Future Milestones**
1. Commercial-scale production of BDO by our partners, to start by end of 2013
2. Sign agreements for additional BDO plants (e.g. in Asia and the Americas)
3. Sign additional partners to our bio-butadiene program, and advance our process
4. Progress toward using biomass as feedstock

**Business Model:** (e.g. owner-operator, technology licensor, fee-based industry supplier, investor)

Genomatica is focused on licensing its process technology to partners as the most effective way to bring our products to market. We can more quickly make an impact by leveraging the scale, operating experience, applications expertise, market expertise, distribution channels and capital of industry leaders.

As examples:
- Novamont has signed a joint venture to license our process technology for the commercial-scale production of BDO in Italy (40 million pounds per year) and is providing all the construction capital;
- Mitsubishi has entered a limited exclusivity agreement regarding BDO plants in Asia;
- Versalis and Novamont have joined our bio-butadiene program, and Versalis has invested in Genomatica;
- Waste Management is working with Genomatica to develop process technology to harness syngas from municipal solid waste as a renewable feedstock;
- Beta Renewables (a joint venture formed from M&G’s Chemtex division) has provided an exclusive license to Genomatica for the production of BDO from biomass via any route.

**Competitive Edge(s):**

*As seen by a licensor:* Genomatica’s processes actually work; deliver competitive economics; and provide feedstock flexibility.

- It works: For example, BDO produced using Genomatica’s process has been successfully converted into major downstream products by multiple companies, speeding product acceptance and integration. The BDO process has been scaling up reliably and along well-known paths, and is moving rapidly toward full commercial-scale production (expected by the end of 2013).
- Process economics are highly competitive: The ultimate proof point has been companies (such as Novamont) investing their own money to build plants based on
a Genomatica technology – providing a significant show of confidence. Industry analysts estimate that Genomatica’s direct, single-step process should have superior economics – in capital expenses and in operating cash costs – than indirect biobased routes for BDO, such as using bio-succinic as an intermediate.

- Feedstock flexibility: Genomatica’s initial process for BDO provides the industry with the use of a range of conventional sugars as an alternative to oil and natural gas. Genomatica is working actively on harnessing biomass as a further alternative, and has also started work on using syngas from municipal solid waste.

For Genomatica, in developing additional processes: Genomatica’s distinctive technology platform – and extensive intellectual property on over 20 major industrial chemicals – provide a significant advantage in approaching and mastering the development of cost-effective processes for multiple intermediate and basic chemicals, over time. This has been validated through the distinctive EPA Presidential Green Chemistry Challenge Award (previously won by a team from the two largest firms in the industry); by initial partnerships with Versalis and Novamont to support Genomatica’s second process (for butadiene); and by Waste Management’s support of a third process to be developed.

Research, or Manufacturing Partnerships or Alliances:
- Beta Renewables and Chemtex: to develop an integrated process for biomass to BDO
- Versalis and Novamont: to develop an integrated process for biomass to butadiene
- Waste Management: develop a process for waste to syngas to chemicals; develop process for a specific chemical
- Novamont: for production of BDO in Italy
- Mitsubishi: exploring production of BDO in Asia

Stage: (Bench, pilot, demonstration, commercial)
- Proven at demonstration scale; ongoing production of tons of BDO,
- Commited commercial-scale partners (e.g. Novamont has purchased a site and is retrofitting for production of BDO using Genomatica’s process).

Website URL: www.genomatica.com

Chief Executive Officer: Christophe Schilling, cschilling@genomatica.com

Business development or sales contact: Bill Baum, bbaum@genomatica.com

Contact for follow up information: (Name, title, phone, email)
Steve Weiss, Marketing, 1.415.215.4400, sweiss@genomatica.com
GeoSynFuels

Address: 14818 W. 6th Ave, Suite A1, Golden, CO 80401

Year founded 2006

Annual Revenues: $0

Company description: GeoSynFuels, LLC ("GSF") is a private, U.S. based company that has developed an economic method for the production of biofuels and biochemicals (including cellulosic ethanol and acetic acid). This technology “bolts-on” to existing sugar cane processing facilities (or other biomass facilities) and enables the production of significant incremental ethanol from the xylose fraction at low cost. The residue from the process (85% of the contained energy and 90% of the fiber) is returned to host facility for its original use such as combustion or pulp production. The commercial viability of the process is grounded in the simplicity of the process and the synergistic sharing of the feedstock.

Major Investors (if a public company, please provide trading symbol and exchange). High net worth family offices, strategic individual investors with knowledge of the biofuel domain.

Type of Technology(ies)
Weak acid hydrolysis, continuous xylose fermentation

Feedstocks:
Bagasse, pulp wood (Yellow Pine, Douglas Fir), other biomass
Products (e.g. ethanol, biobutanol, biodiesel, renewable diesel, renewable jet fuel, power, organic acids, bioplastics etc)
Ethanol, Acetic Acid, Phenolic compounds

Product Cost (if applicable - per US gallon): (Costs per US gallon for fuels, costs per pound for chemicals and/or biomaterials. If you do not manufacture or have long-term stable feedstock pricing, please use the latest December futures contract pricing for traded feedstocks, or $55/ton for untraded biomass – or provide notes on your own feedstock pricing assumptions).
$0.805 per US gallon produced from bagasse
*Feedstock is priced on a opportunity cost basis based on energy extracted vs direct combustion

Offtake partners (if applicable)
Brazil market but not negotiated at this time.

Past Milestones
Developed and operated a 1 tpd pilot facility on bagasse and Yellow Pine. Developed and operated a 10 tpd pilot facility on bagasse. Unit operations established included
pretreatment, hydrolysate conditioning, and fermentation (including microbe development).

**Future Milestones**
Design of a 50 tpd demonstration plant has been completed and construction is expected to start in 2012. Currently negotiating a JV with a Brazilian partner and expect this to be finalized in the 4th quarter of 2011. First commercial facility is expected to be under design in mid 2013.

**Business Model:** (e.g. owner-operator, technology licensor, fee-based industry supplier, investor)

The GSF business model is focused on becoming a technology licensor with exploitation of build-own-operate opportunities where appropriate.

**Competitive Edge(s):**

The ability to extract and ferment five-carbon sugars rapidly and efficiently with supporting technologies for the production of clean xylose hydrolysate. The ability to completely integrate with host site energy balance and product mix.

**Research, or Manufacturing Partnerships or Alliances.**
Donald Danforth Plant Science Center
Sermatec Zanini (large EPC manufacturing group in Brazil)

Stage (Bench, pilot, demonstration, commercial)
Continuous pilot scale testing has been achieved.

**Website URL**
www.geosynfuels.com

**Contact info:**

**Chief Executive Officer:**
J. Todd Harvey
Gevo

Based in:

345 Inverness Dr. South; Bldg. C; Suite 345, Englewood, CO 80112

Year founded:

2005

Technology:

Gevo has two proprietary technologies that combine to make it possible to retrofit existing ethanol plants to produce isobutanol, a four carbon alcohol which serves as a hydrocarbon platform molecule. We have developed a robust industrial scale yeast biocatalyst to produce isobutanol without typical byproducts operating at parameters equivalent to commercial ethanol producers. The second piece of technology is a separations unit that operates continuously and removes isobutanol during fermentation. This helps reduce distillation requirements, thereby reducing process energy consumption. With our exclusive engineering partner, ICM, Gevo plans to complete its first commercial retrofit of a 22 MGPY corn ethanol plant in Luverne, MN and start producing isobutanol by the first quarter of 2012. In the meantime, we will continue to produce ethanol.

Fuel type:

Gevo will produce isobutanol, a four carbon alcohol that can be dehydrated using well known technology to isobutylene, a C4 hydrocarbon. Isobutanol has 30% more energy content than ethanol and can be blended into gasoline without modifying automobile engines. Isobutanol is a low RVP blendstock and less soluble in water than ethanol. It can be transported in pipelines and be dispensed in existing retail pumps. Isobutanol is a biofuel that carries a RIN value of 1.3 and it can be an advanced biofuel from corn if it achieves a 50% GHG reduction.

Isobutanol also has a market as a chemical solvent. The opportunity for isobutylene spans many C4 markets in jet fuel, paraxylene, PET and other multi-billion dollar applications in fuels, synthetic rubber, chemicals and plastics.

Gevo has a number of off-take agreements and has announced non-binding letters of intent to supply Total for gasoline blendstock; United Airlines for biojet; Lanxess for butyl rubber; and, Toray industries for p-xylene.

Major investors:

Khosla Ventures, Burrill & Company, Virgin Green Fund, Malaysian Life Science Fund,
Total SA & LANXESS

Past milestones (09-10):

Gevo successfully commissioned its 1MGPY demonstration plant in late September, 2009 in St. Joseph, MO in cooperation with ICM. In September of 2010, Gevo completed acquisition of the 22 MGPY ethanol plant owned by Agri Energy in Luverne, MN. Retrofit construction is planned to begin early in 2011 and be completed by the end of the year. Isobutanol should begin production in Luverne early in 2012.

3 major milestone goals (2012-13)

We plan to be in commercial production early in 2012 in Luverne, MN. We also plan to bring another 50-200 MGPY of capacity into the development pipeline. Further commercial supply agreements are expected to be announced. In 2012-13, Gevo will begin to implement its ex-USA strategy.

Business model:

Gevo has developed its technology to retrofit ethanol plants to produce isobutanol. Gevo has a flexible business model, i.e., it will own and operate production capacity or align with others in joint venture or lease arrangements. Gevo will also license its technology. We plan to partner with cellulosic conversion companies to develop and commercialize cellulosic isobutanol for the gasoline and jet fuel markets.

Fuel cost: Gevo’s isobutanol should be competitively priced with C4 petrochemical streams and low RVP gasoline blendstock components.

Competitive edge:

Gevo’s proprietary retrofit technology is a cost efficient (approx. $0.40/gallon) and rapid (12 months) retrofit of first generation ethanol capacity to make isobutanol. Gevo’s exclusive collaboration with ICM, the premier engineering services company in the ethanol industry with over 60% of the installed capacity, is another competitive advantage. Finally, our flexible business model enables us to work with investor owned and farmer owned ethanol producers through acquisitions, joint ventures or lease arrangements. Gevo will be able to deploy cellulosic butanol technology as soon as conversion technology is available for biomass refineries.

Alliances and Partnerships:

Gevo has an exclusive collaboration with ICM for the retrofit of ethanol plants in North America. Gevo also has an exclusive technology alliance with Cargill to develop a yeast biocatalyst for cellulosic isobutanol.
Development stage

Commercial

Website:
www.Gevo.com
Glycos Biotechnologies

Company description:
GlycosBio is a biochemical company focused on the production of renewable industrial chemicals using advanced metabolic engineering and fermentation techniques that convert a diversified feedstock portfolio into higher value chemicals. GlycosBio’s suite of bio-based chemicals provide industrial customers and partners with bio-based chemical building blocks, which are direct economic substitutes for petrochemical-based products.

Address:
711 Leverkuhn, Houston, TX 77005

Year founded:
2007

Chief Executive Officer
Richard C. Cilento Jr.

Annual Revenues:
Confidential

Major Investors:
Draper Fisher Jurvetson and DFJ Mercury

Type of Technology(ies):
GlycosBio has developed a portfolio of microorganisms and industrial processes that can biologically make biofuels and biochemicals from a variety of non food-based, low value feedstocks including glycerol, cellulosic sugars, plant oils, algae and fatty acids. This microorganism portfolio approach not only eliminates the risk of a sugar and food-based only feedstock strategy but also provides flexibility in targeting a variety of end chemicals.

Feedstocks:
A key differentiator of GlycosBio’s platform is its ability to utilize diverse feedstocks, some of which in the past have been very difficult to process biologically. These non food-based feedstocks are available today including glycerol from corn ethanol – DDGS; glycerol from sugar cane ethanol – Vinasse; and glycerol and fatty acids from oleochemical and biodiesel plants, to name a few.

Fuel Type (if applicable):
GlycosBio has engineered a series of metabolic pathways that produce nearly a dozen chemical intermediaries including advanced ethanol, isoprene, succinic acid, propanediols and lactic acid.

Fuel Cost (if applicable - per US gallon):
Using GlycosBio’s Glycerol to Ethanol
Manufacturing ("GEM") process, plants with available feedstocks can produce ethanol at approximately a $1.00 per gallon based on the $55/ton figure.

**Offtake partners (if applicable)**
Confidential

**Co-products (if applicable)**
Valuable co products including hydrogen, biologically derived carbon dioxide, and biomass can be leveraged for energy or additional revenue and margin.

**Past Milestones**
1) Q4 2009: operation commenced at the GlycosBio pilot facility with an annual fermentation capacity of up to 150,000 liters.
2) Q1 2010: successful production of lactic acid and ethanol was achieved in GlycosBio’s pilot facility.
3) Q2 2010: plans to construct a biochemical plant and biotechnology research and development facility in Malaysia were announced marking GlycosBio’s first expansion internationally.

**Future Milestones**
1) Q4 2012: complete the construction of GlycosBio’s Malaysian facility marking the company’s first commercial scale facility.
2) Q1 2013: commission additional commercial scale facilities in Latin America and the US.

**Business Model:**
GlycosBio has two business models.
• First, GlycosBio can deploy its platform in an owner-operated business model. The Company’s Bio-XCell facility in Malaysia is an example of this model.
• Second, GlycosBio partners with existing industries under a joint venture co-location framework. Partnership opportunities exist with petrochemical companies, oleochemical companies, enzyme producers and biofuel producers including ethanol and biodiesel plants.

**Competitive Edge(s):**
GlycosBio’s competitive advantages can be shared with industry partners through the joint venture co-location business model framework.
• The Company’s co-location business model creates the ability to leverage existing partner plant assets lowering implementation costs and creating a faster time to market.
• The Company’s flexible plant design and flexible feedstock strategy protects against end product commodity risk as well the market risks associated with food-based feedstocks.
• The Company’s microorganism portfolio and flexible plant design provides a
strategic biochemical alternative platform to companies who are not aligned with sugar-based feedstocks.

**Distribution, Research, Marketing or Production Partnerships or Alliances:**
In 2010, GlycosBio partnered with Malaysian-based BioXCell to build an industrial biochemical plant and biotechnology research and development facility.

**Stage:** *(Bench, pilot, demonstration, commercial)* GlycosBio’s microbial platform has been successfully benched and piloted in the Company’s pilot facility.

In addition, GlycosBio’s Bio-XCell facility will be at commercial scale in Q4 2012.

**Website URL**
www.glycosbio.com
Honeywell’s UOP

Based in: Illinois

Business:

Honeywell’s UOP has developed a renewable jet fuel processing technology, as well as a joint venture. UOP and Ensyn announced the formation of a new joint venture, dubbed Envergent Technologies, that will market technologies and equipment for generating power, transportation fuel and heating oil from biomass using pyrolysis. The joint venture will utilize forest and agriculture residues as feedstocks in a Rapid Thermal process, where feedstocks are heated in the absence of oxygen, to produce pyrolysis oils that can be utilized directly in heating oil or power gen. UOP also owns a Renewable Energy & Chemicals business that produced green diesel using its Ecofining process. UOP and Vaperma announced a partnership to bring Vaperma's polymer membrane technology to the ethanol industry, where it will reduce energy consumption and emissions for for first-generation ethanol, as well as cellulosic ethanol and butanol.

Model:

Licensor; often develops technologies in partnerships.

Past milestones:

In 2006-09, Virgin Atlantic, Continental, Japan Air Lines and Air New Zealand and the group as a whole conducted a series of laboratory, ground and flight tests, indicating that test fuels performed as well as or better than typical petroleum-based Jet A. The tests revealed that using the Bio-SPK fuel blends had no adverse effects on the engines or their components. They also showed that the fuels have an average 1.8 percent greater energy content by mass than typical petroleum-derived jet fuel.

In 2009, at the Paris Air Show Boeing and a series of partners involved in four biofuels-based test flights released the data from the tests, and said that with the release they are on a path towards flight certification of biofuels as soon as late 2010. Future milestones:

UOP expects to commence licensing its fuel technology in 2009, and said that it has already commenced advanced discussions with multiple potential licensees.

The consistent message from airlines and aircraft manufacturers is that the certification of biofuels for regular commercial flights is in the 2012/13 timeline. Boeing spokesman Terrance Scott said that biofuels could be a regular source for jet fuel with 3-5 years, with algae becoming a common component in 8-10 years. Metrics: UOP said that it was modeling future refineries for renewable jet fuel using a 60-150 Mgy scale, and said that while this was only a fraction of the typical 4.2 billion gallon per year scale of a typical oil
refinery that the size was the most effective given the expected supply chain for renewable jet fuel feedstocks. UOP said that it expects the cost of refineries to be in the $150 million range.
Inbicon

Based in:
Denmark

Type of technology:
Cellulosic ethanol from wheat straw via enzymatic hydrolysis.

Type(s) of fuel produced:
Ethanol

Major investors.
Statoil, DONG Energy

Past milestones:

Opened 1.3 Mgy pilot plant in Kalundborg, Denmark in 12/2009.
Inbicon has commenced shipping cellulosic ethanol to Statoil with a 8,00 gallon (28,500 liter) delivery from the Inbicon’s demonstration plant at the Asnaes powerplant in Kalundborg. Overall, Statoil has bought the first five million litres of Inbicon second generation bio ethanol, produced from wheat straw and other agricultural and forestry waste, using enzymes from Novozymes. Statoil, which began offering biogasoline to motorists in 2006, is now also blending under a mandate passed by the Danish parliament in 2009.

Future milestones:

Projects announced in Denmark and China.

Business model:

Licensor.

Fuel cost:
N/D

Competitive edge:
First mover.

Development stage:
Commercial.

Website URL
INEOS Bio

Company description:

INEOS Bio is a BioEnergy company commercializing and licensing its novel thermo-chemical and bio-chemical technology for the production of renewable biofuels and renewable energy from a wide range of low-cost carbon materials. The company’s initial focus is the commercialization of its leading third-generation ethanol technology process to serve the global renewable fuels and the renewable energy markets. Backed by decades of experience in developing and licensing industrial-scale technology, INEOS Bio creates more sustainable communities and transportation by converting waste and non-food crop biomass into advanced biofuel. The INEOS Bio bioenergy technology solution uses a flexible approach that is fast, safe and reliable, allowing it to be commercialized wherever there is waste. By taking this localized approach, INEOS Bio reduces landfill and air pollution, creates jobs, generates tax revenue and safely produces renewable fuel and clean energy. INEOS Bio is one of the global businesses in INEOS, the world’s 4th largest petrochemical company. For more information, visit www.ineosbio.com.

Address:
3030 Warrenville Rd., Suite 650
Lisle, IL 60532  U.S.A.

Global Head Office
Avenue des Uttins, 3
1180 Rolle,
Switzerland

Year founded
1984

Annual Revenues:
NA

Major Investors (if a public company, please provide trading symbol and exchange).
INEOS, is the sole owner of the company and technology.

Type of Technology(ies)
The INEOS Bio process is a combined thermochemical and biochemical technology for ethanol and power production. Under development for over 20 years, including 8 years of successful integrated pilot plant testing, it is comprised of four main steps: (1) feedstock gasification, (2) synthesis gas fermentation (3) ethanol recovery and (4) power generation. The process utilizes a patented fermentation process, where cleaned, cooled synthesis gas is converted selectively into ethanol by a naturally occurring bacterium under anaerobic
Feedstocks:
The INEOS Bio process is feedstock flexible. Unlike other technologies that rely on one primary source of feedstock, the INEOS Bio process has been extensively tested and can produce bioethanol and renewable energy from numerous feedstocks, including vegetative, yard, construction waste, municipal solid waste and forestry and agricultural waste. Use of waste material breaks the link between food crops and ethanol production. This flexibility allows facilities to be built anywhere in the world, wherever there is biomass waste, providing jobs and locally sourced waste solutions and renewable energy for urban and rural communities. The range of organic materials that can be used includes, but is not limited to:

- Municipal Solid Waste (MSW)
- Commercial & industrial wastes
- Contaminated waste wood
- Forestry wastes (e.g. brash, bark, saw dust, wood chippings)
- Agricultural wastes (e.g. sugar cane bagasse, corn stover, straw)
- Lingo-cellulose energy crops (e.g. trees, coppice, miscanthus and switch grass)

Fuel Type (if applicable): (e.g. ethanol, biobutanol, biodiesel, renewable diesel, renewable jet fuel, power etc)
Cellulosic Ethanol

Fuel Cost (if applicable - per US gallon): (If you do not manufacture or have long-term stable feedstock pricing, please use the latest December futures contract pricing for traded feedstocks, or $55/ton for untraded biomass – or provide notes on your own feedstock pricing assumptions).
We forecast the ability to produce cellulosic ethanol for $1.00 per gallon (or less).

Offtake partners (if applicable)
N/A

Co-products (if applicable)
Renewable Power

Three Top Milestones for 2010-11

- Commercial Facility Under Construction – construction began in Spring 2011, is now 25% complete, and will be finished in April 2012
- Successful Financing – all financing has been completed for the first commercial project including strong support from the U.S. Government. First large-scale facility to complete both DOE Grant and USDA Loan Guarantee process.
- Continue Extensive Technology Development – To date the technology has over 340,000 hours in the laboratory and over 45,000 hours of integrated pilot plant time (8+ years);
3 Major Milestone Goals for 2013-15

- Commission the first commercial facility in by year end 2012;
- Build additional larger-scale facilities in the U.S. and around the World;
- License technology globally to third-parties.

**Business Model:** (e.g. owner-operator, technology licensor, fee-based industry supplier, investor)
INEOS Bio is the owner/operator of the first commercial-scale plant via a joint venture. INEOS will build, own and operate facilities and actively license the technology. As the leading licensor of chemical process technology, INEOS currently has over 270 licenses for its technologies in 51 countries around the World. INEOS will utilize a similar approach and leverage its skills, experience and resources to replicate this leading technology on a global basis.

**Competitive Edge(s):**
INEOS Bio is uniquely positioned to commercialize this technology. We have an experienced team of engineers, scientists, IP Legal, business development, logistics, and marketing professionals who have developed and commercialized new chemical process technologies and who have designed, built, commissioned and operated world-scale facilities.

The technology has been successfully demonstrated at an integrated pilot scale utilizing a wide range of feedstocks. No other technology in this space has this type of track record.

The technology has a competitive advantage versus other biofuels technologies through its feedstock flexibility and ability to covert a number of different carbonaceous materials into both biofuels and renewable power. The INEOS Bio technology can be located near both the feedstock and distribution centers, thus providing an advantage for logistics intake as well as fuel off take and generation of renewable power. The ability to use zero or negative cost feedstocks provides an advantage in producing a lower cost and competitive biofuel. The plant has the ability to switch feedstocks based on their availability and relative cost to ensure that we are always using the most economically and environmentally sustainable feedstock at all times.

**Stage (Bench, pilot, demonstration, commercial)**

Pilot to Commercial Scale. Over 8 years of successful integrated pilot plant testing at large scale with varied feedstocks has been completed. The Commercial facility is under construction and will enter service in 2Q 2012.

**Website URL**

www.ineosbio.com
Iogen

Based in:  
Canada

Business:  Cellulosic ethanol production  Model:  Owner-operator.

Past milestones:

In 2009, a Shell station in Ottawa became the first in the country to serve cars with cellulosic ethanol, offering a 10 percent blend of gasoline and wheat straw ethanol manufactured at a demonstration-scale cellulosic ethanol plan jointly owned by Shell and Iogen.

A representative of the joint venture said that a decision on expansion would be reached within 12 months, and did not rule out the possibility of constructing a commercial-scale facility in Idaho, where the company abandoned an effort to build a demonstration-scale plant.

Iogen announced that it had commenced shipments of a 47,000 gallon cellulosic ethanol order from venture partner Royal Dutch Shell. The companies first partnered in cellulosic ethanol in 2002 when Shell invested in Iogen. Shell subsequently increased its ownership stake in Iogen's technology to 50 percent in 2007.

Under an expanded agreement with Shell, Codexis will optimize the efficiency of Iogen Energy's cellulosic ethanol catalysts, as well as developing new to convert biomass directly into green gasoline or green diesel.

Future milestones:

The Saskatchewan provincial government signed an agreement with Iogen to support development the province's first cellulosic ethanol plant at a former pulp mill at Prince Albert owned by Domtar. Iogen will operate the plant, which will be a commercial-scale expansion of its wheat straw ethanol demonstration plant in Ontario. The Canadian government has pledged up to 40 percent of the cost of the project in the form of development grants. The plant will also feature power generation from forest residues.

In 2008, the Canadian federal government approved a $500 million cellulosic ethanol project plan by Iogen Corp for construction in Saskatchewan. Iogen execs said that they hoped to launch the 23 Mgy plant north of Saskatoon by 2011, using wheat straw and other cellulose as feedstock. Iogen is backed in the venture by Shell, Goldman Sachs and Petro Canada.
Metrics:
The Iogen technology has been operating at a 480,000 gallon per year capacity since 2004.
Joule Unlimited Technologies

Address: 83 Rogers Street, Cambridge, MA 02142

Year founded 2007

Annual Revenues: N/A

Company description:

Joule is advancing a production platform for Liquid Fuel from the Sun™, expected to eclipse the scale, productivity and cost efficiency of any known alternative to fossil fuel today. Its transformative Helioculture™ platform directly and continuously converts sunlight and waste CO2 to infrastructure-ready diesel, ethanol or commodity chemicals with no dependence on biomass feedstocks, downstream processing or precious natural resources. This process can yield renewable fuels and chemicals in unprecedented volumes with a fraction of the land required by current methods, leapfrogging biomass-dependent approaches and eliminating the economic and environmental disadvantages of fossil fuels. Additional information is available at www.jouleunlimited.com.

Major Investors (if a public company, please provide trading symbol and exchange).

Flagship Ventures plus private and institutional investors

Type of Technology(ies)

A platform for the direct, continuous conversion of sunlight and waste CO2 to liquid fuels and chemicals.

Feedstocks:

Industrial waste CO2

Products (e.g. ethanol, biobutanol, biodiesel, renewable diesel, renewable jet fuel, power, organic acids, bioplastics etc)

Hydrocarbon diesel, ethanol and multiple chemicals conventionally derived from petroleum

Product Cost (if applicable - per US gallon): (Costs per US gallon for fuels, costs per pound for chemicals and/or biomaterials. If you do not manufacture or have long-term stable feedstock pricing, please use the latest December futures contract pricing for traded
feedstocks, or $55/ton for untraded biomass – or provide notes on your own feedstock pricing assumptions).

Diesel = $0.48/gallon with subsidies ($1.19/gallon without subsidies)
Ethanol = $0.60/gallon with subsidies ($1.23/gallon without subsidies)

Offtake partners (if applicable)

Past Milestones

• Built pilot plant and commenced production.
• Issuance of the company’s first 6 U.S. patents (and counting), with 70+ applications pending.
• Began construction of first demonstration plant in Q3 2011.

Future Milestones

• Complete construction of demonstration plant and begin operations
• Continue technology/system optimization towards ethanol and diesel productivity targets
• Incrementally scale up to commercial production and deployment of facilities worldwide, with commercially available products less expensive than biofuels.

Business Model: (e.g. owner-operator, technology licensor, fee-based industry supplier, investor)
The company intends to commercially develop diesel fuel and also bring products to market via strategic development partnerships. Joule will also provide SolarConverter hardware, technology and deployment know-how transfer and controlled access to production strains.

Competitive Edge(s):

• Proven conversion of sunlight and waste CO2 directly into infrastructure-ready

Products: diesel (hydrocarbons), ethanol and value-added chemicals
• Directly produces fungible fuels vs. oils that require refining or chemical upgrading
• No dependence on costly biomass feedstocks or complex processing/logistics
• An integrated system up to 100X more efficient than biomass-dependent processes
• Productivity up to 15,000 gal diesel/acre/year and 25,000 gal ethanol/acre/year
• Costs (including capital) as low as $20/bble of diesel and $0.60/gal ethanol, including subsidies
• Fully modular system and scalable to billions of gallons with comparatively minimal land use
• Ecologically-sound process doesn’t require arable land or fresh water
• Strong IP position with 6 U.S. patents granted and 70+ applications filed
• World-class team of biologists, biochemists, engineers, industrial experts and executive leadership

Research, or Manufacturing Partnerships or Alliances.

Stage (Bench, pilot, demonstration, commercial)

Joule has build out its first modules at its demonstration facility.

Website URL

www.jouleunlimited.com
KiOR

Address: 13001 Bay Park Road, Pasadena, TX 77507

Year Founded: 2007

Company description:

KiOR is a next-generation renewable fuels company that has developed a proprietary technology platform to convert sustainable non-food biomass into cellulosic gasoline, diesel and fuel oil. Using standard refinery equipment, KiOR’s products are compatible with the existing fuel infrastructure. KiOR strives to ease dependence on foreign oil, reduce lifecycle greenhouse gas emissions and create high-quality jobs and economic benefit across rural communities.

Major Investors (if a public company, please provide trading symbol and exchange).
Nasdaq: KiOR

As of 8/31/12 Khosla Ventures, Artis Capital, Alberta Investment Management Corporation and other major direct and institutional holders were major investors in KiOR.

3 Top Milestones for 2009 – 2012:
1. Development and commercialization of the Company’s proprietary biomass-to-cellulosic fuels technology.
2. Acquire funding for the Company’s capital and operating requirements through the public and private capital markets.
3. Development and construction of the Columbus, Mississippi facility, KiOR’s first commercial scale cellulosic fuel production facility.

3 Major Milestone Goals for 2013 – 2015
1. Successful completion, commissioning and operation of the Columbus, Mississippi facility.
2. Development and construction of KiOR’s first commercial cluster of production facilities, consisting of four standard conversion facilities (three times larger than the Columbus facilities) and two upgrading facilities for production of cellulosic gasoline and diesel.
3. Continued research and development on KiOR’s proprietary biomass-to-cellulosic fuels technology platform to reach targeted yield and throughput goals.

Business Model: (owner-operator, technology licensor, fee-based industry supplier, investor)
Owner-operator and “value share” joint venture participant

**Competitive Edge(s):**
1. Breakthrough technology based on well-established refining processes.
2. World’s first “drop in” cellulosic hydrocarbon gasoline and diesel (as opposed to ethanol or biodiesel) producible at commercial scale.
3. Cellulosic fuel that can be cost-competitive with traditional fossil fuels but with 80% reduction in lifecycle greenhouse gas emissions than fossil fuels.
4. Feedstock flexibility on all types of sustainable, non-food biomass.
5. Enhances energy independence and increases energy security.

**Research, or Manufacturing Partnerships or Alliances.**
None

**Stage** (Bench, pilot, demonstration, commercial)
Commercial

**Website URL:**
www.kior.com

**Chief Executive Officer:**
Fred Cannon

**Business development or sales contact:**
John Kasbaum, SVP, Commercial

**Project information: Columbus, MS**

**Materials or products produced**
Cellulosic gasoline and diesel

**Capacity (Millions of US gallons per years)**
13 Million GPY

**Year, month in service (planned or projected)**
September, 2012

**Status: (Open, Under Construction, Planned)**
Commencing operations
Feedstock:
Forestry Residuals

Processing technology (e.g. advanced fermentation, enzymatic hydrolysis)
Proprietary catalytic pyrolysis-based biomass-to-cellulosic fuels technology platform resulting in renewable crude oil that is upgraded with standard hydro processing units into hydrocarbon diesel and gasoline products.

Project notes, if any
Facility output sold out prior to commencement of construction
Construction took approximately 13 months from ground breaking to mechanical completion and cost approximately $213 million

EPC partner, if any
KBR

Project information: Natchez, MS

Materials or products produced
Cellulosic gasoline and diesel

Capacity (Millions of US gallons per years)
40 Million GPY

Year, month in service (planned or projected)
2H 2014

Status: (Open, Under Construction, Planned)
Planned

Feedstock:
Forestry Residuals

Processing technology (e.g. advanced fermentation, enzymatic hydrolysis)
Proprietary catalytic pyrolysis-based biomass-to-cellulosic fuels technology platform resulting in renewable crude oil that is upgraded with standard hydro processing units into hydrocarbon diesel and gasoline products.

Project notes, if any
Scheduled to break ground Q1 2013

EPC partner, if any: KBR
Product information: KiOR Cellulosic Gasoline
Product Description:
KiOR Cellulosic Gasoline is a hydrocarbon fuel that can drop in to the existing transportation fuels infrastructure, including pipelines, interchangeably with its petroleum-based counterparts to produce finished gasoline fuels meeting ASTM specifications. KiOR cellulosic gasoline has a higher energy content compared to ethanol.

Product Applications:
Component of finished gasoline meeting all ASTM International specifications; compatible with all engines, and appropriate for today’s cars and trucks.

Unique Features (i.e., what separates this product from the competition, whether bio-based or incumbent fossil-based products – e.g. cost, performance features).
Cellulosic biofuel designation from EPA, together with the higher energy content of KiOR fuels compared to ethanol make our products attractive to fuel producers because they can be used to satisfy specific volume requirements for cellulosic biofuel as well as the volume requirements for both advanced biofuels and renewable fuel under RFS2. Significant energy density superiority over ethanol (up to 40% higher) while achieving six times greater life cycle greenhouse gas emissions as compared to corn ethanol. Non-food cellulosic feedstock allows structural production cost advantage over ethanol with comparable capital intensity compared to other second generation biofuels.

Feedstocks and bio-based content (e.g. “20% soy-based”)
Only non-food, lignocellulosic feedstock.

Wholesale or retail Product price: (if applicable)

Parity price
Cash production cost of $1.50 or lower per gallon if produced in a standard commercial production facility using primarily forestry residual feedstocks.

Website URL:
www.kior.com

Product photo URL: (if available)

Head of sales,
John Kasbaum, SVP, Commercial
Product information: KiOR Cellulosic Diesel

Product Description:
KiOR Cellulosic Diesel is a hydrocarbon fuel that can drop in to the existing transportations fuels infrastructure, including pipelines, interchangeably with its petroleum-based counterparts to produce finished diesel fuels meeting ASTM specifications. KiOR cellulosic diesel has a higher energy content compared to ethanol.

Product Applications:
Component of finished fuel meeting all ASTM International specifications; compatible with all engines, and appropriate for today's cars and trucks.

Unique Features (i.e., what separates this product from the competition, whether bio-based or incumbent fossil-based products – e.g. cost, performance features).
Cellulosic biofuel designation from EPA, together with the higher energy content of KiOR fuels compared to ethanol make our products attractive to fuel producers because they can be used to satisfy specific volume requirements for cellulosic biofuel as well as the volume requirements for both advanced biofuels and renewable fuel under RFS2. Significant energy density superiority over ethanol (up to 40% higher) while achieving six times greater life cycle greenhouse gas emissions as compared to corn ethanol. Non-food cellulosic feedstock allows structural production cost advantage over ethanol with comparable capital intensity compared to other second generation biofuels.

Feedstocks and bio-based content (e.g. “20% soy-based”)
Only non-food, lignocellulosic feedstock.

Wholesale or retail Product price: (if applicable)

Parity price, e.g. competitive with $XX oil: (if applicable, in BPOE, US$)
Cash production cost of $1.50 or lower per gallon if produced in a standard commercial production facility using primarily forestry residual feedstocks.

Website URL:
www.kior.com

Product photo URL: (if available)

Head of sales,
John Kasbaum, SVP, Commercial
LanzaTech

Address: 725 C E. Irving Park Road, Roselle, IL USA 60172

Year Founded: 2005

Company description:

LanzaTech has developed a fully sustainable integrative gas to fuels and chemicals platform that has no impact on food, water security or high biodiversity land use. The proprietary gas-to-liquid platform produces fuels and high value chemicals such as 2,3-butanediol (2,3 BDO) and acetic acid from a variety of waste gas resources.

The production of ethanol and 2,3 BDO is significant for the alternative aviation fuels industry as LanzaTech has successfully converted these products into fully synthetic jet fuel via catalytic and thermochemical routes, together with a conversion partner. 2,3 BDO can also be converted into butadiene, a high-volume intermediate for production of plastics, rubber and nylon.

LanzaTech’s technology platform uses different microbial strains to produce products from gases that contain carbon monoxide (CO) with or without hydrogen (H2) or gases containing carbon dioxide (CO2) and H2 providing a novel approach to carbon capture and reuse.

LanzaTech’s biological microbes can utilize the lowest cost, most readily available gas resources including waste industrial flue gases from steel mills, processing plants and refineries; syngas generated from any biomass resource (such as municipal biowaste, organic industrial waste, and agricultural waste); coal derived syngas; and reformed natural gas are all resources for the LanzaTech gas fermentation process.

Major Investors (if a public company, please provide trading symbol and exchange).
Dialog Group Berhad, K1W1, Khosla Ventures, Malaysian Life Sciences Capital Fund (MLSCF), PETRONAS Technology Ventures, Qiming Venture Partners

3 Top Milestones for 2009-12

1. Series B and C investment: $18 million and $55.6 million respectively.
2. Construction of a 100,000 gallons per year demonstration plant in collaboration with BaoSteel.
3. Partnership agreements in place globally including eight Global Fortune 500 Companies across multiple sectors (steel, coal, oil refining, aviation, biomass/MSW and chemicals).

3 Major Milestone Goals for 2013-15

1. First commercial facility in operation at a steel mill in China; producing 30 million gallons of ethanol per year.
2. Demonstrate production of C4 chemicals.
3. Initiate 2 additional commercial facilities.

Business Model: (e.g. owner-operator, technology licensor, fee-based industry supplier, investor)

Two business models: technology licensor and part owner-operator by way of JVs. Business model for any specific project determined by location and customer preference. Either model capital light as plant fully funded by customer/JV partner.

Competitive Edge(s):

Global platform for sustainable gas fermentation.
**Waste gases from Industry**

The LanzaTech process is the only process that converts waste gases to fuels and chemicals, from any source of CO or CO$_2$. LanzaTech has proven its gas fermentation process using industrial waste gases with its proprietary microbe. Waste gases have never been used before as a nutrient source as the conditioning process makes it economically unfeasible. LanzaTech’s microbe does not require the gases to be conditioned and so they are able to use this available low cost waste product as a nutrient for growth. A unique strength of LanzaTech is its in-house synthetic biology capability, which allows for engineering and further development of its microbe, enabling the expansion of a diverse product slate into higher value chemical markets going forward.

**Fuels and chemicals through carbon capture, reuse and sequestration**

LanzaTech’s strategy is to diversify its product portfolio beyond ethanol to key chemical intermediates and drop in aviation fuels through developing key technology partnerships. Diversification mitigates market risk by ensuring that the company has commercially viable options to meet changing demands.

Through LanzaTech’s process, carbon (as CO or CO$_2$) is successfully captured and safely sequestered into new chemical products, such as butadiene and isobutylene. Isobutylene is one of the most important petrochemical building blocks that can be converted into fuels, plastics, organic glass and elastomers. It can also be directly converted to polymers and jet fuel relevant C8-C12 molecules.

LanzaTech is working with Global Bioenergies, whose core technology consists in a proprietary artificial pathway allowing the direct fermentative production of isobutylene from renewable resources. This pathway has so far been expressed in a classical production microorganism using carbohydrates such as glucose as feedstock. LanzaTech’s unique microbes, present a novel pathway that can use nonfood resources as feedstocks, specifically carbon monoxide gas, for isobutylene production.
Butadiene is used extensively in production of rubbers and other polymers and produced by dehydration of 2,3 BDO or directly by fermentation of CO. Production of butadiene is seen as critical, as it is typically produced as a by-product of ethylene derived from cracking naptha. However, natural gas availability and pricing is driving displacement of cracker derived C2’s, therefore reducing C4 olefin availability. LanzaTech’s joint development project with INVISTA will accelerate the 2,3 BDO optimisation work as well as develop a direct single step process to produce butadiene directly through a process of gas fermentation.

LanzaTech’s unique microbes, through an effective biological carbon capture and sequestration (CCS) technology provide a novel path to chemical production with sound economics.

Research, or Manufacturing Partnerships or Alliances.

Research: Chinese Academy of Sciences, Pacific Northwest National Laboratory, National Renewable Energy Laboratory, Swedish Biofuels, NICE, Tsinghua University, US Department of Energy, Defense Advanced Research Projects Agency (DARPA), Michigan Technological University, Delaware University, US Department of Transportation - Federal Aviation Administration and Volpe Center

Manufacturing partnerships: Baosteel, POSCO, Jindal Steel, LCY Chemicals, Indian Oil Company, Henan Coal and Chemical Company, Petronas: feedstock providers.
Mitsui and Harsco: strategic alliances,
Virgin Atlantic, Boeing: Aviation
INVISTA: Chemicals
Stage:
Demonstration operating in China
2nd Demonstration ETA Q4 2012

Website URL: www.lanzatech.com

Chief Executive Officer: Dr. Jennifer Holmgren

Business development or sales contact:
Prabhakar Nair

Project information (see tables below)

**Waste Gas to Fuel : LanzaTech Pilot Plant**

<table>
<thead>
<tr>
<th>Location:</th>
<th>Auckland, New Zealand</th>
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<tbody>
<tr>
<td>Materials or products produced ethanol</td>
<td>Ethanol</td>
</tr>
<tr>
<td>Capacity (Millions of US gallons per years)</td>
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<tr>
<td>Year, month in service (planned or projected)</td>
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<td>Feedstock:</td>
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<tr>
<td>Processing technology (e.g. advanced fermentation, enzymatic hydrolysis)</td>
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<tr>
<td>Project notes, if any</td>
<td>Pilot Project</td>
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<td>EPC partner, if any</td>
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**Waste Gas to Fuel: LanzaTech BaoSteel New Energy Co., Ltd.**

**Shanghai, China**

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<tr>
<td><strong>Materials or products produced ethanol</strong></td>
<td>Ethanol</td>
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<tr>
<td><strong>Capacity (Millions of US gallons per years)</strong></td>
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<td><strong>Year, month in service (planned or projected)</strong></td>
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<td>Demonstration Project</td>
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<td><strong>EPC partner, if any</strong></td>
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Waste Gas to Fuel: Beijing Shougang LanzaTech New Energy Technology Co., Ltd.

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<tr>
<td>Materials or products produced ethanol</td>
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<tr>
<td>Capacity (Millions of US gallons per years)</td>
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<td>Demonstration Project</td>
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<td>EPC partner, if any</td>
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### Biomass Syngas to Fuel: LanzaTech Freedom Pines Biorefinery

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<tr>
<td>Capacity (Millions of US gallons per years)</td>
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<td>Project notes, if any</td>
<td>Commercial Project</td>
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<td>EPC partner, if any</td>
<td>LanzaTech</td>
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</tbody>
</table>

LanzaTech Freedom Pines Biorefinery located in Soperton, Georgia USA
**MSW Syngas to Electricity and Fuel with Concord Enviro Systems PVT Ltd**

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<th>Location:</th>
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<td>Materials or products produced ethanol</td>
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<td>Capacity (Millions of US gallons per years)</td>
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<td>Year, month in service (planned or projected)</td>
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<td>Status: (Open, Under Construction, Planned)</td>
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<td>Demonstration Project</td>
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<tr>
<td>EPC partner, if any</td>
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</tbody>
</table>

**Product information**

For each existing or planned product, please complete

**Product Brand Name:**

TBC

**Product Description:**

Fuel grade ethanol, 2,3 BDO, butadiene, acetic acid, isobutylene

**Product Applications:**

Ethanol: Fuel blending; conversion to drop-in jet fuel.

2,3 BDO/butadiene: conversion to hydrocarbon fuels, conversion to butadiene for rubbers, plastics and nylon market

Acetic acid: low cost production from LT, enables economic conversion to lipids and subsequent
conversion to jet fuels.

Isobutylene: Can be converted into fuels, plastics, organic glass and elastomers. It can also be directly converted to polymers and jet fuel relevant C-12 molecules.

**Unique Features** (i.e., what separates this product from the competition, whether bio-based or incumbent fossil-based products – e.g. cost, performance features).

LanzaTech is the only technology to have a diverse range of products derived from a wide variety of waste gases, including those from industry. These products can be produced through a process that requires no dedicated feedstock infrastructure and uses resources that are low cost and readily available. Gas resources can be fed directly into the LanzaTech process at source. This gas would otherwise be flared as a GHG-effectively making LanzaTech derived products novel ways unique stores of waste carbon.

**Feedstocks and bio-based content** (e.g. “20% soy-based”)

**Wholesale or retail Product price:** (if applicable)

n/a

**Parity price, e.g. competitive with $XX oil:** (if applicable, in BPOE, US$)

Ethanol produced via LanzaTech technology when processing steel mill off-gases is cost competitive with ethanol produced via existing sugar and/or starch fermentation technologies.

CCOP/Gal for China Corn model is $2.33, US corn $1.81-$3.19, Brazil sugarcane $1.44

LanzaTech model using China BOF gas $1.28 and using China coal syngas $1.67

**Website URL:**

www.lanzatech.com

**Head of sales:** Prabhakar Nair
LS9, Inc.

Address: 600 Gateway Blvd., South San Francisco, CA 94080

Year founded 2005

Company description:
LS9, Inc. is a technology leader in the commercial development of a growing portfolio of sustainable products to meet the needs of established and expanding fuel and chemical markets worldwide. Its unique technology platform enables low costs, feedstock flexibility and process simplicity across a diversity of fermentation-derived products including vehicle-ready fuels and chemicals for lubricants, detergents and personal care products. In June 2010, LS9 was awarded the U.S. Environmental Protection Agency's highest environmental honor for its revolutionary technology.

Major Investors (if a public company, please provide trading symbol and exchange).
Flagship Ventures, Khosla Ventures, Lightspeed Venture Partners, Chevron Technology Ventures and BlackRock

Type of Technology(ies): Microbial bioprocesses for the conversion of renewable carbohydrates to a diversity of drop-in fuel and chemical products. All of the chemical steps occur inside LS9’s engineered microbial catalysts, and the products are naturally secreted into the growth medium where they form an immiscible organic phase that is easily recoverable. The one step process is simple, efficient, and cost effective, enabling low CapEx multi-use facilities. LS9 is a world leader in the application of Synthetic Biology in the development of its proprietary microbial catalysts.

Feedstocks: Carbohydrate molecules including, sugar cane syrup and molasses, corn syrup and starch, glycerin, and sugar stream derived from biomass.

Products
LS Diesel™
LS Jet Fuel™
LS Biodiesel™
LS Fatty alcohol™
LS Esters™
LS Parafins™
LS Olefins™

Product Cost (if applicable - per US gallon):
At full scale commercial production levels, LS9 estimates fuel production costs will be Approximately $1.50 per gallon at historical sugar cane prices in Brazil.
Offtake partners (if applicable)
None disclosed at this time.

Past Milestones
• Raised $30 Million in December 2010
• Extended relationships with Chevron and P&G for hydrocarbon fuels and chemicals for personal care.
• Brazil - office established and partnership with Man Latin America

Future Milestones
• Commercial partnerships for fuel and chemical products
• Additional fundraising
• First commercial plant

Business Model: (e.g. owner-operator, technology licensor, fee-based industry supplier, investor)

Owner-operator
Licensor

Competitive Edge(s):
• LS9 technology platform enables a diverse portfolio of products for various applications: diesel, jet fuel, surfactants, lubricants, polymers, solvents, emollients, flavors and fragrances, etc. Each produced using the same bioprocessing and recovery technology and basic capital infrastructure.
• LS9 renewable drop-in fuels require no change in distribution or vehicle infrastructure.
• LS9 sustainable drop-in chemicals enable diversification of raw materials, suppliers, and geographies with competitive economics and lower carbon footprint.
• LS9 fuel hydrocarbons have highest yields and most cost effective one-step processes that require no hydrogenation.
• LS9’s processes affect a 85%+ decrease in carbon footprint relative to petroleum based processes.
• LS9’s technology is feedstock flexible – cane syrup, corn syrup, starch, waste glycerin, molasses, and biomass derived sugar streams.

Research, or Manufacturing Partnerships or Alliances.
• Procter & Gamble – joint development and commercialization of LS9 technology in the production of chemicals for consumer products. Two product development agreements established, the first in 2009, the second in 2010.
• Chevron – expanded research partnership directed at further improving LS9’s platform technology to produce specific pure hydrocarbon products.
• MAN Latin America – partnered with this leading Brazilian engineering and vehicles manufacturing company to test LS9’s renewable diesel in both stationary engines and
operational fleet vehicles in Brazil. The project will include performance, emissions, fuel consumption and engine durability testing, as well as field testing of LS9’s biofuel in Volkswagen trucks and buses.

- **HCL Clean-Tech** - awarded a $9 million grant from the Department of Energy (DOE) together with partner HCL CleanTech Ltd. to improve and demonstrate an integrated process to convert biomass feedstocks into fermentable sugars and then into diesel and other fuel and chemical products.

Stage
Pilot successfully operating since 2008, with barrels of fuel and chemical products produced and evaluated by third parties. Starting in early 2010, LS9 has been operating at 20,000L scale, and will transition to its 140kL commercial demonstration facility in Okeechobee, Florida, in December 2011.

Website URL: www.ls9.com

Contact info:

**Chief Executive Officer:** Ed Dineen
Lygos

Address: 2929 7th Street, Suite 120 Berkeley, CA 94710

Year Founded: 2011

Company description: Lygos develops high-efficiency, novel processes to produce renewable chemicals by using our expertise in synthetic biology and metabolic engineering. Lygos is a spin-off from the lab of Professor Jay Keasling, Director of the Joint BioEnergy Institute in Emeryville, CA

Major Investors: Pre-Series A

3 Top Milestones for 2009-11: Developed a crucial high throughput screen for initial products; established high throughput work flow and data management; and rapidly drove first product from proof of concept to optimization.

3 Major Milestone Goals for 2013-15: Current efforts focus on demonstrating biological and biological + chemical routes to several renewable products with significant commercial markets; developing key partnerships for feedstock, production, and marketing / distribution of renewable chemical products, and securing a first major round of investment.

Business Model: Commercial options range from technology licensing through JV’s to build / own / operate

Competitive Edge(s): Expertise in synthetic biology, metabolic engineering, and high-throughput screening, plus strong licensed and internally-developed IP estate. Initial products have highly-favorable theoretical yields and ~100% selectivity of biological pathways, Lygos expects to produce many products with substantial economic advantages over petrochemical routes. As a result, these products will be commercially viable without mandates, subsidies, exorbitant crude oil prices, or “green premiums,” although of course those will provide even greater advantages where available.

Research, or Manufacturing Partnerships or Alliances: Under development / in negotiation

Stage: Bench

Website URL: www.lygos.com

Chief Executive Officer: J. (Clem) Fortman

Business development or sales contact: Paul F. Bryan
Contact for follow up information: (Name, title, phone, email):

J. (Clem) Fortman  
CEO

Paul F. Bryan  
VP – Business Development
Mascoma

Based in:
67 Etna Road, Suite 300, Lebanon, NH 03766

Year founded:
2005

Technology:
Consolidated Bio-Processing (see below)

Fuel type:
Ethanol

Major investors:
Flagship Ventures, Khosla Ventures, Atlas Venture, General Catalyst Partners, Blue Sugarsiner Perkins Caufield & Byers, VantagePoint Venture Partners, General Motors, Marathon Oil

Past milestones:
First demonstration of CBP technology
Opening of demonstration facility in Rome, NY
Funding from the State of Michigan for commercial ethanol production facility

Future milestones:
Breaking ground on Michigan commercial production facility
Transfer of advanced CBP technology to our demonstration plant in Rome NY
Completing next round of funding

Business model:
Owner / Partner

Fuel cost:

Mascoma Corporation is actively involved in research. Not producing ethanol commercially. According to models, the final cost of fuel continues to decrease.

Competitive edge:

The unique technology developed by Mascoma Corporation uses yeast and bacteria that are engineered to produce large quantities of the enzymes necessary to break down the cellulose and ferment the resulting sugars into ethanol. Combining these two steps (enzymatic digestion and fermentation) significantly reduces costs by eliminating the need for enzyme produced in a separate refinery. This process, called Consolidated Bioprocessing or "CBP", will ultimately enable the conversion of the solar energy contained in plants to ethanol in just a few days.

Alliances and Partnerships:

GM, Chevron, Marathon Oil, US DOE, State of NY, State of Michigan

Development stage: Demonstration

Website:

www.mascoma.com
Mendel Biotechnology

Address: 3935 Point Eden Way, Hayward, CA 94545

Year founded 1997

Annual Revenues: not disclosed

Company description: Mendel is an innovative biotechnology company leveraging its core technology capability to serve three major business segments: Traits for row crop agriculture, Agricultural chemistry and BioEnergy Seeds. Our BioEnergy Seeds business is developing a transformative perennial crop system to provide bioenergy industry with a cost effective and scalable lignocellulosic feedstock crop platform. Our seeded miscanthus product PowerCane Miscanthus™, which will be launched this fall, will offer farmers and end-users an option to establish and grow high-yielding perennial crop using standard agricultural practices, including direct seeding option. Utilizing our knowledge of conventional breeding and trait technology, we will supply new and improved energy crop varieties for the bioenergy market to continue improving energy crop productivity and its economics.

Major Investors (if a public company, please provide trading symbol and exchange). Biotech Value Fund, BP, Monsanto, Ziff Brothers Investments.

Type of Technology(ies):
b) Traits: Leading independent agbiotech company developing novel yield and stress traits for major row crops.
c) Chemistry: Providing innovative chemical solutions leveraging our understanding of genetic pathways

Feedstocks: N/A

Products (e.g. ethanol, biobutanol, biodiesel, renewable diesel, renewable jet fuel, power, organic acids, bioplastics etc): Miscanthus and Miscanes under PowerCane Miscanthus™ brand, biotech traits for food and feed crops, research & development for agricultural chemistries.

Product Cost (if applicable - per US gallon): (Costs per US gallon for fuels, costs per pound for chemicals and/or biomaterials. If you do not manufacture or have long-term stable feedstock pricing, please use the latest December futures contract pricing for traded feedstocks, or $55/ton for untraded biomass – or provide notes on your own feedstock pricing assumptions). N/A
Offtake partners (if applicable): Not disclosed

Past Milestones:
1. Seeds (Validated performance of seeded miscanthus system in the field)
2. Traits (Validation of next generation biotech trait discovery platforms)
3. Chemistry (Validation of novel agricultural chemistry discovery strategy)

Future Milestones:
1. Seeds - establish commercial acreage of direct seeded miscanthus and launch PowerCane Miscanthus™ brand of products
2. Traits - launch of first Mendel-developed traits in commercial application
3. Chemistry - validated pathways identified for chemistry discovery

Business Model: (e.g. owner-operator, technology licensor, fee-based industry supplier, investor):
   a) Bioenergy: integrated seed company
   b) Trait & Chemistry technology: technology developer and licensor

Competitive Edge(s):
   a) Bioenergy: Miscanthus giganteus is widely recognized as one of the most productive, low-input energy crop species. Mendel has developed proprietary, seeded Miscanthus varieties which are as productive as current, non-proprietary, clonal Miscanthus giganteus varieties. These are used in Mendel’s complete seeded miscanthus production system, greatly reducing establishment costs and accelerating deployment of production acres compared to current vegetative propagation methods (e.g., via rhizomes)
   b) Trait & Chemistry technology: pioneer in the application of advanced plant gene regulatory pathway knowledge, derived through plant transcription factor research, to improved biotech traits and chemistry discovery. Mendel has created an extensive patent position on key pathways and methods; highly effective, innovative and results-oriented research team.

Research, or Manufacturing Partnerships or Alliances. Monsanto, BP, Bayer Crop Sciences

Stage (Bench, pilot, demonstration, commercial): demonstration/commercial

Website URL: www.mendelbio.com

Contact info:

Chief Executive Officer: Neal Gutterson, PhD.
Mercurius Biofuels

Address: 3190 Bay Road, Ferndale, WA 98248

Year founded 2009

Annual Revenues: 0

Company description: Mercurius Biofuels was formed with a mission to develop and commercialize a novel and efficient biomass to biofuels technology.

Major Investors (if a public company, please provide trading symbol and exchange). Currently funded by DOE and TAP grants along with founder’s funds.

Type of Technology(ies) Liquid phase / catalytic thermo-chemical (ethanolysis) conversion of whole biomass to non-sugar intermediates that are further processed to cellulosic diesel and jet fuel hydrocarbons.

Feedstocks: Any lingo-cellulosic material

Products (e.g. ethanol, biobutanol, biodiesel, renewable diesel, renewable jet fuel, power, organic acids, bioplastics etc)


Product Cost (if applicable - per US gallon): (Costs per US gallon for fuels, costs per pound for chemicals and/or biomaterials. If you do not manufacture or have long-term stable feedstock pricing, please use the latest December futures contract pricing for traded feedstocks, or $55/ton for untraded biomass – or provide notes on your own feedstock pricing assumptions).

$0.90/gallon excluding capex costs.

Offtake partners (if applicable): None at this time.

Past Milestones
1. Completed initial bench scale research on all 3 steps of process.
2. Competed in 2010 CleanTech Open as a Pacific NW Semi-Finalist.
3. Started-up Micro-Pilot Plant at EERC.

Future Milestones
1. Fund, build, and operate a Pilot Plant sized at 1-10 TPD.
2. Fund and design commercial plant.
3. Start construction on commercial plant.

**Business Model:** (e.g. owner-operator, technology licensor, fee-based industry supplier, investor)
- Plan A – own and operate biorefineries.
- Plan B – technology licensor.

**Competitive Edge(s):** Competitive edges include: low opex and capex, feed flexibility, high value chemical by-products.

**Research, or Manufacturing Partnerships or Alliances:** EERC, PNNL

**Stage (Bench, pilot, demonstration, commercial):** Micro-Pilot stage.

**Website URL:** www.mercuriusbiofuels.com
Mintz Levin Cohn Ferris Glovsky and Popeo PC (Mintz Levin)

Address: 701 Pennsylvania Avenue N.W., Suite 900, Washington, DC 20004

Year Founded: 1933

Annual Revenues: The firm does not disclose this information.

Company description: Mintz Levin is a full-service, multi-disciplinary, international law firm of approximately 500 attorneys and senior professionals, with offices in Boston, Washington, D.C., New York, Stamford, Los Angeles, San Francisco, San Diego, London and Tel Aviv. Mintz Levin was one of the first law firms to establish a dedicated clean technology practice. Today, Mintz Levin leads the field in clean tech IPOs, and is one of the only law firms that considers its Energy & Clean Technology Practice among its top industry practices. Since 2006, Mintz Levin’s Energy & Clean Technology Practice has closed transactions in the energy and clean technology sector totaling more than $4 billion in transaction value. Mintz Levin was ranked #2 nationally among top Clean Technology law firms, according to Watershed Capital Group, and in 2011 the practice was listed as a "Best Law Firm" for clean tech by U.S. News & World Report, both in Boston and nationally. Recently, the practice was also ranked among the 2012 "40 Hottest Partners in Bioenergy and Bio-based Materials" by Biofuels Digest. Mark Riedy was recently named one of the Top 100 Bioenergy Leaders in the world by Biofuels Digest. Mintz Levin's Energy & Clean Technology Practice Group includes more than 40 attorneys and professionals from across the firm's offices dedicated to offering clients a blend of comprehensive legal and government relations expertise, and practical business counseling. With over 300 energy and clean technology clients, attorneys in the Energy and Clean Technology Practice Group, working with professionals from the firm's consulting affiliate, ML Strategies, are proud to represent many of the leading clean technology companies and innovative industry pioneers. For more information about Mintz Levin, please visit www.mintz.com.

Major Investors (if a public company, please provide trading symbol and exchange).
Mintz Levin Cohn Ferris Glovsky & Popeo is a Limited Liability Partnership.

3 Top Milestones for 2009-12

- Co-developed and had introduced into each of the USDA’s three loan guarantee programs, project company bonds credit-enhanced with loan guarantees; drafted the first Congressional bill to qualify biofuels, biochemical, renewable power and infrastructure for master limited partnership (MLP) treatment; co-developing the use of covered project bonds without government support to provide long term/low cost coverage of 100% of senior debt and technology risks; drafting the first-ever Treasury guidance to include renewable fuels and infrastructure for real estate investment trust (REIT) treatment; and co-developed the use of Systems Performance Insurance to wrap the technology risks on first commercial advanced biofuels and biochemical projects.
- Represented more than 12 US and foreign energy companies in the successful procurement of conditional loan guarantees from the US Department of Agriculture and/or major grants and loan guarantees from the US Department of Agriculture for integrated advanced biofuel and bio chemical refineries, including biopower plants. To date, we have closed 3 of the integrated biorefinery loan guarantees for advanced biofuels and biochemical clients.

- Currently representing seven integrated biorefineries for commercial projects in the Navy, USDA and DOE investment program of $510 million, and two pilot/demonstration projects in the DOE grant program for military advanced biofuels, and represented two of them in the receipt of successful funding through the related DARPA grant program.

3 Major Milestone Goals for 2013-15

- Close all remaining conditional loan guarantees for our awardee-USDA clients; close the financing for all client awardees under each of the Navy-USDA-DOE commercial project and DOE pilot and demonstration project programs; complete multiple covered bond transactions and System Performance Insurance – backed closings domestically and internationally for our renewable fuel, chemical and power clients; use available U.S. and international loan guarantees to credit-enhance project bonds; complete the qualification of biofuels, biochemical, renewable power and infrastructure for MLP and REIT financing treatment.

- Continue to increase the size and scope of our Clean Technology and Renewable Energy Practice group with the intention of substantially increasing the transaction value of our closings beyond $4 billion.

- Continue to develop and mature our current and new company and project level financing mechanisms for domestic and international renewable energy (fuels and power), renewable chemical and related infrastructure transactions.

**Business Model:** (e.g. owner-operator, technology licensor, fee-based industry supplier, investor) Mintz Levin is a Limited Liability Partnership that has approximately 500 attorneys and senior professionals.

**Competitive Edge(s):**
As the global appetite for energy continues to grow, so does the demand to change the way it is delivered and consumed. Adapting to this changing environment presents significant challenges and opportunities. As the first law firm in the eastern United States to build a dedicated energy and clean technology practice group, Mintz Levin has been repeatedly recognized as one of the nation’s top domestic and international law firms in the sector.
Our industry-leading attorneys focus on the convergence of technology and industry in regulated markets and provide services at that intersection. We lead the field in completing clean tech public offerings and our experience in venture capital and private equity, bond finance, project finance, mergers and acquisitions, and other corporate transactions is unmatched. Having experience at the crossroads of the investment, traditional energy, and clean tech industry means we also handle government funding, environmental, land use, real estate, intellectual property, litigation, and legislative and regulatory matters. Whether you are an investor, a traditional energy provider, or a clean technology entrepreneur, we have the critical insight needed to help you create, execute, implement, and succeed at your business goals.

**Research, or Manufacturing Partnerships or Alliances.**
The firm’s nine offices (Boston, Washington, D.C., New York, Stamford, Los Angeles, San Francisco, San Diego, London, Tel Aviv) are strategically located to meet the evolving needs of the firm’s domestic and international clients, alike. Also, our vast network of international relationships spans the globe and lends itself to providing efficient and trustworthy legal and business guidance.

**Stage** (Bench, pilot, demonstration, commercial)
Mintz Levin is a 79 year old firm that was established in 1933. It is highly successful, well respected and established law firm.

**Website URL:** www.mintz.com

**Chief Executive Officer:**
R. Robert Popeo
Chairman

Thomas R. Burton, III
Member, Chair Energy & Clean Technology Practice

Sahir Surmeli
Member, Co-chair Energy & Clean Technology Practice

Mark J. Riedy
Member, Co-chair Project Finance Practice

Audrey Louison
Member, Co-chair Project Finance Practice

**Business development or sales contact:**
Wendy Decker
WDecker@mintz.com
Muradel

Address: 239 Magill Rd, Adelaide, Australia

Year Founded: 2010

Company description: Algae biofuels technology development

Major Investors (if a public company, please provide trading symbol and exchange).
SQC Pty Ltd, Adelaide Australia

3 Top Milestones for 2009-11
Progressed from Proof of Concept to Technology Development.
- Discovery and validation of an elite high salinity, high yielding microalgae.
- Construction and operation of a 2 acre Pilot Plant near Karratha, Western Australia
- Development of a high efficiency, low energy algae harvesting technology

3 Major Milestone Goals for 2013-15
Scale up to demonstration scale
Integration of viable downstream biomass conversion technology
Target outcome to be “Investment Ready”

Business Model: (e.g. owner-operator, technology licensor, fee-based industry supplier, investor)
Operated as a limited liability, private Company
Scope to be an owner operator of licensee of technology

Competitive Edge(s):
MUR Elite algae strains
MUR Algae Harvesting System
Australian owned and based
Access to very considerable areas of marginal land
Excellent climate for algae production
Strong Government support
Research, or Manufacturing Partnerships or Alliances.
Partnerships with Aban, India, OTHERS TBA

Stage (Bench, pilot, demonstration, commercial)
Pilot Plant with 20 and 200 sq m raceway ponds

Website URL: www.muradel.com.au

Project information: Karratha, Western Australia
Adelaide, Australia

Materials or products produced
Algae biofuel technology
Algae biomass concentrate
Green Crude in the future

Capacity ( Millions of US gallons per years)

By 2015: 1650 T/yr
By 2018 60,000T/yr

Year, month in service (planned or projected)
Status: (Open, Under Construction, Planned)
Pilot Plant completed Dec 2010
Demo plant 2013/14
Full scale commercial module of 20 ha 2015
Commercial Plant expansion 2015> 2018

Feedstock: Algae

Processing technology (e.g. advanced fermentation, enzymatic hydrolysis)
Open raceway ponds with an Elite saline tolerant micro algae strain
MUR Harvesting System
Downstream SCWR biomass conversion

Other notes:

Muradel was established as a consequence of a very successful R&D project funded by the Australian Government, the 2 participating Universities (Murdoch and Adelaide) and SQC Pty Ltd 2008-2011.

A 3 year technology /R&D program on downstream biomass conversion options with government and SQC support was commenced in mid 2011.

The Company is targeting further government funding support for 2012/2015

EPC partner, if any

➢ Aban, Chennai
➢ Others TBA
Myriant Corporation

Address:
One Pine Hill Drive
Batterymarch Park II
Quincy, MA 02169

Year Founded: 2008

Company description:
Myriant is building a global renewable chemicals company. Our innovative technology platform produces “green” chemicals from renewable feedstocks that are cost competitive without requiring a green premium. These green chemicals “drop-in” to chemical manufacturing processes to displace chemicals derived from petroleum. We are developing and selling bio-chemical intermediates that provide us with access to established markets representing a market opportunity in excess of $40 billion.

In December 2010, Myriant broke ground on its flagship 30 million pound commercial bio-succinic acid facility in Lake Providence, Louisiana. The company’s D(-) lactic acid started production at commercial scale in June 2008 for use in polylactic acid. Myriant has agreements with Uhde GbH for engineering, Davy Process Technology for the integration of Myriant’s succinic acid process with the Davy butanediol process for the production of bio-based butanediol, and PTT Chemical for the commercialization of Myriant’s technology in South East Asia.

Major Investors (if a public company, please provide trading symbol and exchange).
PTT Global Chemical

3 Top Milestones for 2009-11

• Receiving $50M grant from the Department of Energy for the construction of a first-of-its-kind, 30M lb/yr bio-succinic acid plant to be built in Lake Providence, LA
• Securing PTT Global Chemical as a strategic investor
• Signing contracts in excess of the 30M lb capacity of the Lake Providence plant with customers around the globe

3 Major Milestone Goals for 2013-15

• Complete construction and commercial start of the bio-succinic acid plant in Lake Providence, LA
• Initiate construction of our world-scale bio-succinic acid plant and sign customer contracts for its entire 140M/lb/yr capacity
• Advance bio-acrylic program to pilot stage and sign corporate partner

Business Model: (e.g. owner-operator, technology licensor, fee-based industry supplier, investor)
Build-own-operate, with opportunistic partnerships and joint-ventures, when appropriate

**Competitive Edge(s):**
- First commercial plant fully funded and on track for a planned commercial start in Q1’13. First plant fully contracted, with signed customer contracts and demonstrated customer demand in excess of 30M/lb nameplate capacity.
- Commercialized product: Our technology platform was commercialized for the production of D(−) lactic acid through our licensee. Myriant is now focused on commercializing its second product, bio-succinic acid.
- Validated proprietary technology with low carbon footprint: Our proprietary process sequesters carbon rather than releasing it contributing to a small carbon footprint.
- Demonstrated ability to successfully scale and commercialize the technology platform
- Low-cost producer of sustainable and profitable unit level economics: We believe we can produce our products at an average of half the cost of traditional petrochemical intermediates at a wide range of oil and industrial sugar prices without relying on green premiums or government subsidies
- Feedstock flexible: We have demonstrated equivalent yields on a wide variety of biomass sources
- Strategic relationships established with leaders in the fields of chemicals, process technology, and engineering
- Experienced team with a demonstrated track record of building commercial scale plants and executing against business plans to build value for shareholders.

**Research, or Manufacturing Partnerships or Alliances.**
- Davy Process Technology: Integrate and provide process guarantees for BDO
- Uhde ThyssenKrupp: Technology validation and process guarantees/EPC wrap
- PTT Global Chemical: Strategic investor; investigating feasibility of a joint venture to build a bio-succinic acid plant in southeast Asia
- BlueStar: MOU for 220M lb succinic acid plant
- Showa Denko: Succinic acid customer for the production of PBS
- Sojitz: Exclusive marketing partner in Japan, Greater China and Korea

**Stage** (Bench, pilot, demonstration, commercial)
- Commercial – D(−) lactic acid and bio-succinic acid
- Development - bio-acrylic
- Research – bio-muconic

**Website URL:**
www.myriant.com

**Chief Executive Officer:**
Stephen J. Gatto, Chairman & CEO

**Business development or sales contact:**
Alif Saleh, Global Vice President, Sales and Marketing
Project information: Lake Providence, Louisiana

Materials or products produced: Bio-succinic Acid

Capacity (Millions of US gallons per years): 30M lbs/yr

Year, month in service (planned or projected): 1Q’13

Status: (Open, Under Construction, Planned): Under construction

Feedstock: Flexible

Processing technology (e.g. advanced fermentation, enzymatic hydrolysis): Single Step Fermentation

Product information: Myriant's bio-succinic acid:
Myrifilm® solvent
Myriflex® for plasticizers
Bio-succinic acid is also utilized as a chemical replacement, intermediate and drop-in chemical (see below).

Product Description:
Myriant’s bio-succinic acid represents a market opportunity of approximately $7.5 billion, as a replacement for petroleum-derived succinic acid, as a BDO drop-in for current applications, and as a replacement for adipic and phthalic acids.

Product Applications:
Myrifilm® solvent offers manufacturers of adhesives, paints and coatings for carpets, papers, and other products a cost-effective, green alternative with exceptional performance. Produced using renewable, non-food-based feedstocks, Myrifilm® solvent has zero Volatile Organic Compounds (VOCs), is HAPS-free, and odor-free.

Myriflex® for plasticizers can be used in plasticizers for PVC or any resin compound currently using adipate or phthalate plasticizers. Based on Myriant's bio-succinic acid, Myriflex-based plasticizers offer green, sustainable alternatives that enable manufacturers to transition away from phthalates, without compromising performance.

Myriant's Bio-Succinic acid is one of the two primary intermediates used to manufacture
PBS, and is a building block chemical in the production of 1,4-butanediol (BDO). Myrian's bio-succinic acid is a true drop-in replacement for petroleum-based succinic acid, enabling manufacturers to produce a truly bio-based, biodegradable polymer.

Myrian's Bio-Succinic acid can be used as a replacement for petroleum-based adipic acid for the production of polymers, esters and polyester polyols, improving the environmental footprint and price stability of the raw material supply chain.

Unique Features (i.e., what separates this product from the competition, whether bio-based or incumbent fossil-based products – e.g. cost, performance features).
1. Low carbon footprint
2. No green price premium
3. Non-food based
4. High performance

Feedstocks and bio-based content (e.g. “20% soy-based”)
Feedstock flexible technology platform: industrial sugars, glucose, sucrose and cellulosic feedstocks

Parity price, e.g. competitive with $XX oil: (if applicable, in BPOE, US$)
Based on current commercial-scale costs and using widely available industrial sugar as a feedstock, we estimate that the production process for our bio-succinic acid will be cost-competitive with petroleum-based processes at oil prices as low as $45 per barrel.

Website URL: www.myriant.com

Head of sales,
Alif Saleh
Neste Oil

Address:
Neste Oil's headquarters Neste Oil Oyj Keilaranta P.O. Box 95
00095 NESTE OIL

Year founded
Established in 1948

Annual Revenues:
Around EUR 11.9 billion in 2010

Company description:
Neste Oil is a refining and marketing company, with a production focus on premium-quality, lower-emission traffic fuels. The company produces a comprehensive range of major petroleum products and is the world's leading supplier of renewable diesel. The company has operations in 15 countries. Its growth strategy is focused on producing premium-quality renewable diesel fuel.

The company had net sales of EUR 11.9 billion in 2010 and employs around 5,000 people.

Major Investors (if a public company, please provide trading symbol and exchange). Neste Oil's share is listed on the NASDAQ OMX Helsinki. The company's biggest shareholder is the Prime Minister's office.

Type of Technology(ies)

Neste Oil has developed a premium quality NExBTL renewable diesel production technology which allows flexible use of any vegetable or waste oil in the production of premium-quality renewable diesel and aviation fuel. Based on its technical qualities, NExBTL diesel is one of the best diesel fuels in the world. NExBTL is produced by hydrotreating vegetable or waste oils. As a hydrocarbon it corresponds to the chemical composition of traditional diesel.

Neste Oil’s major investment projects are linked to increasing the company’s NExBTL renewable diesel capacity. In 2011, Neste Oil started up the Europe’s largest renewable diesel plant in Rotterdam. The plant has a capacity of 800,000 t/a. Neste Oil already operates a renewable diesel plant in Singapore that came on stream in 2010 and two plants in Porvoo in Finland that came on stream in 2007 and 2009. All Neste Oil’s NExBTL plants are capable of producing both NExBTL renewable diesel and NExBTL renewable aviation fuel.

With the Rotterdam start-up, Neste Oil’s major €1.5 billion investment program aimed at
increasing the renewable diesel capacity and the company is very well placed to meet world’s growing energy needs and demand for cleaner, sustainable bio-based fuels.

**Feedstocks:**

Neste Oil's NExBTL renewable diesel production technology allows flexible use of any vegetable or waste oil in the production of premium-quality renewable diesel without compromising on quality.

At the moment, Neste Oil produces NExBTL renewable diesel from a mix of palm oil, stearin and palm oil fatty acid distillate (PFAD) which are by-products of palm oil production, rapeseed oil, jatropha oil, camelina oil, soybean oil as well as waste animal fat produced by the food processing industry.

Widening the raw material base is one of the company’s main future goals. About 80% of the company’s R&D costs totaling approximately 40 million euros annually are directed to researching renewable raw materials. Progress continues to be made and in 2011 Neste Oil expanded the raw material feedstock with jatropha oil, camelina oil and soybean oil. In addition, research has shown that algae oil and microbial oil, together with wax derived from wood-based biomass, can all be used as feedstocks for producing NExBTL renewable diesel.

Notable successes in this area include: patented a waste-based microbial oil technology progressed with research on algae oil and produced an initial trial batch achieved good results at our pilot plant in producing biowax from wood-based biomass and started environmental impact assessments for a possible commercial plant partnered with the world’s leading research institutes, companies and universities to find ways to produce renewable raw materials on industrial scale.

Products (e.g. ethanol, biobutanol, biodiesel, renewable diesel, renewable jet fuel, power, organic acids, bioplastics etc)

NExBTL renewable Diesel

Based on Neste Oil's proprietary technology, premium-quality NExBTL renewable diesel is the most advanced diesel fuel on the market today. It easily outperforms both conventional biodiesel and fossil diesel, and can be produced from a flexible mix of vegetable oils and waste animal fat sourced from the food industry. Neste Oil's procurement chain ensures that all the raw materials it uses for NExBTL are produced responsibly. NExBTL renewable diesel has been shown to reduce greenhouse gas emissions by over 40% over the product's entire life cycle when compared to fossil diesel. Its lower tailpipe emissions also make a valuable contribution to enhancing overall air quality.

NExBTL renewable aviation fuel Neste Oil is a global pioneer in aviation biofuels. The
company’s NExBTL renewable aviation fuel meets the very stringent quality standards demanded of aircraft fuel and can be produced in industrial quantities. Production of Neste Oil’s renewable aviation fuel is based on the company’s NExBTL technology.

NExBTL renewable aviation fuel can significantly reduce an aircraft’s greenhouse gas emissions compared to fossil fuel. In addition to a smaller carbon footprint, it also offers lower emissions of other pollutants such as NOx. Neste Oil’s NExBTL renewable aviation fuel is a pure hydrocarbon comparable to fossil-based aviation fuel. NExBTL renewable aviation fuel is fully compatible with all current aircraft engines and no aircraft-related investments or modifications are needed before it can be used.

**Product Cost** (if applicable - per US gallon): (Costs per US gallon for fuels, costs per pound for chemicals and/or biomaterials. If you do not manufacture or have long-term stable feedstock pricing, please use the latest December futures contract pricing for traded feedstocks, or $55/ton for untraded biomass – or provide notes on your own feedstock pricing assumptions).

Neste Oil does not share this information publicly.

**Offtake partners** (if applicable)
Not applicable.

Past Milestones

1. Based on Neste Oil’s investment in technology and R&D, we produced NExBTL; a renewable diesel that is a better-quality product than both conventional biodiesel and fossil diesel. Compared to fossil diesel, NExBTL reduces greenhouse gas emissions by over 40% over its entire lifecycle. NExBTL is currently being sold to consumers in Finland and to other oil companies in Europe and North America to be used as a premium quality biocomponent. It can be used in blends in any concentration, i.e. 0–100% of the content. We also increased the production capacity of NExBTL diesel, which is now available on industrial scale. We started up three plants in Finland, Singapore and Rotterdam and increased our total production capacity to 2.0 million t/a.

2. Lufthansa started commercial flights powered by Neste Oil’s NExBTL renewable aviation fuel in summer 2011. This was the first time that renewable fuel is used in regular commercial airline service. Neste Oil is currently one of the only companies in the world capable of producing renewable aviation fuel at commercial scale.

3. Neste Oil is committed to using only sustainably produced bio-based raw materials. The company has developed its own sustainability verification system which exceeds the industry standards for renewable raw material procurement and meets the requirements of legislation. Our commitment to expanding the raw materials portfolio has meant Neste Oil has successfully widened its raw material base to produce NExBTL renewable diesel. About 80% of the company’s R&D costs totaling approximately 40 million euros annually are directed to researching renewable raw materials.
New raw materials, such as jatropha, camelina and soybean oils have been introduced. In addition, research has shown that algae oil and microbial oil, together with wax derived from wood-based biomass, can all be used as feedstocks for producing NExBTL renewable diesel. Neste Oil’s work on sustainability has received recognition in numerous international comparisons for many years in succession (e.g. Dow Jones Sustainability Index, Global 100 list, Forest footprint disclosure).

Future Milestones
1. Generate profitable growth in the renewable fuels market by developing global customer base and supply chain, expanding the feedstock base, ensuring smooth operation of the new production plants and taking part in developing and planning new legislation.
2. Continue researching and introducing new raw materials. When selecting its inputs, Neste Oil prioritises suppliers that follow sustainable cultivation and production practices and have a good greenhouse gas balance. The final deployment decision is also affected by raw material availability and consistency of supply, as well as price.
3. Develop new applications, such as NExBTL renewable aviation fuel, that help customers to reduce greenhouse gas emissions and dependence on fossil fuels.

Business Model: (e.g. owner-operator, technology licensor, fee-based industry supplier, investor)

Neste Oil is a refining and marketing company, that produces renewable fuels based on its proprietary NExBTL technology. The company owns and operates four production plants producing NExBTL renewable diesel. The output of the plants is sold to other oil companies in European and Northern American markets to be used as a premium quality bio-component.

Competitive Edge(s):
Neste Oil’s strategy is founded on its unique ability to refine premium-quality fuels from a wide range of different, cost-effective feedstocks. Specialisation and in-depth expertise are central to enabling Neste Oil to succeed in the international marketplace, despite its small relative size.

Neste Oil’s strengths in renewable fuels business include: cutting-edge NExBTL technology and product, growing production capacity, and industry-leading operations based on sustainable raw material procurement. Additionally, Neste Oil’s expertise in research and technology is one of the company’s key success factors.

Research, or Manufacturing Partnerships or Alliances.

NExBTL renewable diesel, for example, is the outcome of an intensive R&D effort. Neste Oil has invested around EUR 40 million annually in R&D in recent years, of which around 80% has gone on research into renewable raw materials and technology for refining these inputs.
Neste Oil is involved in research in both completely new raw materials such as microbes, algae, and wood-based biomass, and existing alternatives such as used cooking oil and waste fat from the fish processing industry.

Neste Oil cooperates closely with some of the world’s leading research institutes and companies.

Neste Oil and Stora Enso are collaborating on research into utilizing wood biomass. The partners will decide whether to go ahead with basic engineering on a 200,000 t/a plant when the question of public subsidy for the project is solved.

Neste Oil, Boreal Plant Breeding, and Raisio are developing high-yielding rapeseed varieties that could be used as a raw material for renewable diesel.

Neste Oil has researched waste-based microbial oil in cooperation with the Aalto University School of Technology.

Neste Oil takes part in international algae research projects in Australia and the Netherlands to test various methods for growing algae in outdoor conditions. Neste Oil and the Finnish Environment Institute have launched a joint algae research program testing the lipid production capacity of different types of algae and analyzing how the quality and quantity of these lipids can be optimized by adjusting the conditions under which algae are grown.

Neste Oil cooperates with approximately 25 universities and research institutes worldwide.

Stage (Bench, pilot, demonstration, commercial) NExBTL diesel can be produced in large volumes on an industrial scale it is currently in commercial production. In the future, Neste Oil’s aim is to launch commercial production of NExBTL renewable aviation fuel that can be produced at Neste Oil’s existing refineries in Finland, Singapore and Rotterdam.

Website URL

www.nesteoil.com

Contact info:
Neste Oil's headquarters Neste Oil Oyj Keilaranta P.O. Box 95
00095 NESTE OIL Tel: +358 10 45811

Chief Executive Officer:
President & CEO Matti Lievonen
Novozymes A/S

Company description:
Novozymes is the world leader in bioinnovation. Together with customers across a broad array of industries we create tomorrow’s industrial biosolutions, improving our customers' business, and the use of our planet's resources.

With over 700 products used in 130 countries, Novozymes’ bioinnovations improve industrial performance and safeguard the world’s resources by offering superior and sustainable solutions for tomorrow’s ever-changing marketplace. In 2010, Novozymes’ products globally reduced CO2 emissions by 40 million tons.

Novozymes offers the leading technology platform for biofuel production; we are the leading enzyme provider for ethanol enzymes in all regions where we operate.

Address:
Krogshoejvej 36
2880 Bagsvaerd
Denmark

Year founded
2000 (Prior to 2000, a division within Novo Nordisk)

Chief Executive Officer and contact email:
Steen Riisgaard, str@novozymes.com

Annual Revenues:
1st half 2011: DKK 5,229 million (~USD 0.95 billion)
2010: DKK 9,724 million (~USD 1.77 billion)
2009: DKK 8,448 million (~USD 1.65 billion)

Company description:
Novozymes is the world leader in bioinnovation. Our business is industrial enzymes, microorganisms, and biopharmaceutical ingredients. Our biological solutions help companies make more from less, as our solutions save energy and raw materials, and reduce waste. The result is higher quality, lower costs, lower CO2 emissions, and a better environment.

Novozymes is organized into two business areas, each covering a number of industries: Enzyme Business and BioBusiness. The development, production, distribution, and sale of enzymes form the major part of our business, currently accounting for 94% of sales. BioBusiness, accounting for the remaining 6%, is home to both a smaller, established
business in microorganisms and biopharmaceutical ingredients and a portfolio of initiatives where Novozymes is exploring business opportunities outside the enzyme sphere.

We use biotechnology to discover new sustainable solutions. More than 16% of Novozymes’ global workforce of 5,432 works on innovation and development, and we invest around 14% of our sales in research and development.

Our solutions are based on a unique technology platform that provides a wealth of opportunities for the world’s industries. Gene technology, microbiology, and fermentation technology are some of the tools on which we base our business. Combining industrial insight with this technology platform, we partner with customers across a broad range of industries to create tomorrow’s industrial biosolutions that not only improve the use of our planet’s resources but also our customers’ business. We currently hold more than 6,500 granted or pending patents, which is an indication of the possibilities that emerge when nature and technology join forces.

Sustainability is an integral part of our business, and we enable our customers to optimize their use of raw materials and energy, thereby reducing the environmental impact of their operations. In 2010 alone, the worldwide application of our products enabled reductions in CO2 emissions of approximately 40 million tons.

We believe in decency and responsibility in business, which includes respect for all stakeholders. Our commitments to international agreements and universal values help define issues and challenges of relevance to our stakeholders and our business:

- We subscribe to the United Nations Global Compact
- We support the United Nations Declaration of Human Rights
- We support the United Nations Convention on Biological Diversity
- We subscribe to the International Chamber of Commerce’s Charter for Sustainable Development

Major Investors (if a public company, please provide trading symbol and exchange). Novozymes A/S has two share classes: A shares and B shares. The B shares are listed on NASDAQ OMX Copenhagen under ticker code NZYM B and ID code/ISIN DK0010272129.

The A common stock is held by Novo A/S, which is wholly owned by the Novo Nordisk Foundation. In addition, Novo A/S holds 5,826,280 B shares (11%). Altogether this gives Novo A/S 25.5% of the total common stock and 70.1% of the votes.

As of June 2011, Novozymes had roughly 50,000 holders of the B shares, of which around 98% were private investors, mainly in Denmark. Institutional shareholders owned roughly two thirds of the B common stock, and about 60% of the B common stock is held outside Denmark.
**Type of Technology(ies)**

Novozymes’ core technology for the biofuels industry is enzymes that break down different types of feedstock into fermentable sugars for conversion into ethanol. Within this area, Novozymes develops solutions for two distinct types of ethanol technology: cellulosic ethanol and starch-based ethanol.

Novozymes cellulosic ethanol work is the largest endeavor the company has ever undertaken, with over 150 scientists dedicated to the effort. Not only is Novozymes’ developing and offering the leading enzyme solutions for cellulosic ethanol technology, but we have also expanded our research focus into optimizing the pretreatment, hydrolysis and fermentation process steps.

In 2010 Novozymes launched the first commercially viable enzyme for the cellulosic ethanol industry, Cellic® Ctec2. The 1.8X average performance improvement over a variety of feedstocks is enabling our partners to reach a commercially viable enzyme cost window and overall production costs. We have also worked with many of our partners to help optimize their process technology in order to lower enzyme use cost and find the right balance in process tradeoffs to lower capital and operating costs.

As the world leader in bioinnovation, Novozymes produces enzymes that optimize the conversion of grains such as corn, barley, wheat and other starch raw materials into ethanol. Unrivalled in their performance and ease of use, our enzymes enable higher yields, faster throughput and lower processing costs. Our tailored solutions – including custom enzyme blends – match the specific needs of our customers’ processes for liquefaction, saccharification, fermentation enhancement, and viscosity reduction.

**Feedstocks:**

Novozymes’ enzyme solutions provide robust performance on a wide variety of feedstocks. Cellulosic ethanol employs biomass feedstocks such as corn stover, wheat straw, sugarcane bagasse, woody residues, switchgrass, etc. For starch-based ethanol, the primary feedstocks are corn, barley, wheat, sugarcane, etc.

**Products**

Our enzyme solutions breakdown feedstock, such as corn and lignocellulosic material into sugars that can be used to produce: ethanol, biobutanol, renewable jet fuel, organic acids, biochemicals and bioplastics. These enzyme solutions include the following product families: Liquozyme, Spirizyme, Viscozyme, Provia and Cellic

**Product Cost (if applicable - per US gallon):**

Companies with the most advanced process technologies are reaching $0.50/ gallon ethanol produced enzyme use costs with our product, Cellic Ctec2.

For starch based ethanol, most customers are achieving a $0.02-$0.04/gallon ethanol produced enzyme use cost.
**Offtake partners** (if applicable)
Some of our partners in cellulosic ethanol include: POET, ICM, GreenField Ethanol, Fiberight, Lignol, CTC, Petrobras, Inbicon, M&G, COFCO and Sinopec

**Past Milestones**
1) In 2010, Novozymes launched Cellic CTec2, the first commercially viable enzyme for cellulosic ethanol production. A follow-up to our original Cellic CTec enzyme, CTec2 provides more than twice the performance of the original, driving the enzyme use cost down to as low as $.50 per gallon of ethanol produced.

2) Also in 2010, Novozymes launched Spirizyme® Excel, an advanced saccharification solution that makes it possible to produce more ethanol from the same amount of corn. Spirizyme Excel converts the most difficult starch fractions, allowing producers to increase yields by more than one percent. Compared to other solutions, a typical ethanol plant can gain $1 million or more per year using the enzyme.

3) 2009 - Novozymes launched Cellic CTec, our first commercially available enzyme that helped enable the transition from pilot to demo scale for our cellulosic ethanol partners

**Future Milestones**
1) Deliver higher-performing cellulosic enzyme solutions to help ethanol plants make cellulosic ethanol cost competitive with starch based ethanol production; working with our partners in demonstrating their cellulosic ethanol technology is commercially viable.

2) Deliver the first million gallons of commercially-viable cellulosic ethanol to the world through our enzyme development and partnership efforts.

3) Start-up of Blair, Nebraska enzyme production facility to deliver enzymes to the US biofuels industry

**Business Model:**
Novozymes supplies enzymes to the bioethanol production industry and is the global market leader. We provide the ethanol industry with the best use cost via higher performing enzymes that deliver greater yields and efficiencies to our customers’ operations as well outstanding customer service optimizing plants efficiencies. Novozymes spends more than 14 percent of our annual revenue on research and development of new innovative solutions for our customers and the industry.

For cellulosic ethanol, we have forged partnerships with the leading technology developers in the industry in order to help enable commercialization. We are well positioned to continue our legacy of being the leading enzyme supplier to this industry through our unmatched product performance and customer value offering.
Competitive Edge(s):
Novozymes has been the leader in starch based ethanol since the industry has taken off and we are positioned to do the same for cellulosic based ethanol. We accomplish this through our commitment to R&D and always providing the highest performing enzymes coupled with the industry’s best technical services team. This winning combination enables our customers to have peace of mind that their plants are running optimally.

Research, or Manufacturing Partnerships or Alliances.
Novozymes is the market leader in all segments and partners with many of the industry leaders, such as POET, M&G, GreenField, ICM, Inbicon, COFCO, Sinopec, and Ceres to optimize their technology for ethanol production.

Stage (Bench, pilot, demonstration, commercial)
For starch based ethanol, we are the industry leader in supplying the commercial scale bioethanol plants with enzymes. In cellulosic ethanol, we partner and supply our enzymes to several of the industry leaders who are currently at pilot and demo scale. One partner recently broke ground on the first large scale cellulosic plant, which is M&G/Chemtex. This plant is expected to be operational in 2012.

Website URL
www.bioenergy.novozymes.com

Chief Executive Officer:
Steen Riisgaard
Oakbio Inc.

Address: 265 Sobrante Way, Suite T, Sunnyvale, CA 94086
Year founded: Oct 2009
Annual Revenues: zero

Company description: Oakbio Inc. has developed a biotechnology-based process and proprietary microbial platform for cost-competitive manufacture of sustainable non-petroleum derived chemicals and fuels. Our microbial bioreactor system captures CO2 from waste industrial gases and generates chemicals and fuels. Our process will contribute to amelioration of atmospheric CO2 accumulation by sparing use of petroleum oil to make chemicals, and, by using waste CO2 that would otherwise be released. We call our process of creating chemical value from waste CO2 gas carbon-capture and conversion (CCC).
Our products are designated sustainable2 to represent simultaneous use of renewable energy and sparing of atmospheric CO2 accumulation.
We don’t use biomass or agricultural feedstock. We use waste CO2 and renewable energy.

Major Investors (if a public company, please provide trading symbol and exchange). NA


Feedstocks: Waste gas streams from industry containing CO2 are our sole carbon source. H2 gas is our sole energy source: either 100% sustainable in origin (e.g. solar power and water electrolysis) or derived by steam reformation of natural gas.

Products: Biodegradable polymers, alcohols, fatty acids, carotenoids.

Product Cost (if applicable - per US gallon): No feedstock from plants. CO2 waste gas and H2 gas are our only inputs. Product Cost linked closely to H2 cost.

Offtake partners (if applicable): Collaboration partner for on-site prototype testing to be announced Q3/2011.


**Business Model:** Owner-operator or technology licensor as suited to different chemicals and markets. Strategic partnering with CO2 producers and Chemical Companies to access inputs and markets respectively.

**Competitive Edge(s):** Unique technology for creating value from otherwise wasted CO2. Value for producer of waste CO2 (GHG reduction) and for Oakbio in production of sustainable chemicals at competitive cost. Complete independence from agriculture and competition for commodity sugars by food and fuels markets. Microbe platform and Molecular Engineering allows virtually infinite redesign of output chemicals to suit strategic partners and market opportunities. Advantage of very early and continuous testing of product concepts at a site of industrial CO2 production.

**Research, or Manufacturing Partnerships or Alliances.** First to be announced Q3, 2011.

**Stage:** Lab-bench and small scale at industrial site using industrial gas supply.

**Website URL:** www.oakbio.com
OPX Biotechnologies, Inc.

Address: 2425 55th Street, Suite 100
Boulder, CO 80301

Year Founded: 2007

Company description:
OPX Biotechnologies, Inc. (OPXBIO) is a Boulder, Colorado-based company using its proprietary, leading EDGE™ (Efficiency Directed Genome Engineering) technology platform to manufacture bio-based chemicals and fuels that deliver more sustainable value to our customers.

OPXBIO has successfully developed the pilot-scale process for making of its first bio-based chemical product – BioAcrylic - from a range of sugar feedstocks. OPXBIO is now producing BioAcrylic at large demonstration-scale in anticipation of first commercial production in 2014-2016. In 2011, OPXBIO began collaborating with The Dow Chemical Company, the largest U.S. producer of petro-acrylic, to develop the commercial process for producing BioAcrylic. Today’s petro-acrylic has a $10 billion global market with applications in products such as paints, adhesives, diapers and detergents.

OPXBIO has also proved its second bio-based product at lab-scale, using carbon dioxide and hydrogen to produce fatty acid for chemical and fuel applications. A $6 million award from the U.S. Department of Energy ARPA-E program supports this development.

Major Investors (if a public company, please provide trading symbol and exchange).
Investors supporting the company include Altira Group, Braemar Energy Ventures, DBL Investors, Mohr Davidow Ventures, US Renewables Group, Wolfensohn Capital Partners, and X/Seed Capital.

3 Top Milestones for 2009-12

1. OPXBIO achieves BioAcrylic fermentation at 3,000-liter scale

2. OPXBIO begins collaboration with The Dow Chemical Company to develop an industrial scale process for the production of bio-based acrylic acid from renewable feedstocks
   http://opxbio.com/press/Dow_and_OPXBIO_Collaborating_on_Renewable_Route_to_Acrylic_Acid.php

3. In just 18 months of pilot-scale development, OPXBIO demonstrated a manufacturing process for making performance-equivalent BioAcrylic that is
more sustainable than petroleum-based acrylic.


3 Major Milestone Goals for 2013-15:
1. OPXBIO is now producing BioAcrylic at large demonstration-scale in anticipation of first commercial production in 2014-2016

2. Additional partnership(s) for additional chemical(s)

3. Successful completion of the ARPA-E Electrofuels Program

Business Model: (e.g. owner-operator, technology licensor, fee-based industry supplier, investor)
The company is focused on developing microbes and bioprocesses that can cost effectively produce bio-based chemicals and fuels. Most of this work is done at the pilot scale (laboratory or bench scale) and demonstration scale (100,000s of lbs per year). To develop the commercial scale facilities (100,000,000s of lbs per year), the company intends to enter into strategic partnerships and joint ventures. The company intends to participate in the commercialization of all its products as a joint venture partner. OPXBIO will fund its own technology development and the initial development of new bio-based chemicals and fuels. This strategy allows OPXBIO to concentrate on its core competencies of microbe and bioprocess development and leverage the expertise of its partners for commercialization.

Competitive Edge(s):
The EDGE™ (Efficiency Directed Genome Engineering) technology platform enables rapid, rational, and robust optimization of microbes and bioprocesses to manufacture bioproducts with equivalent performance and improved sustainability compared to petroleum-based alternatives.

Using EDGE, OPXBIO identifies the genes that control microbial metabolism and then implement a comprehensive, rational genetic change strategy to simultaneously optimize microbial production pathways and vitality as well as overall bioprocess productivity.

EDGE includes a first-of-its-kind, massively parallel, full genome search technology known as SCALEs. The EDGE technology is 1,000 to 5,000 times faster than conventional genetic engineering methods, meaning OPXBIO creates optimized microbes and bioprocesses within months rather than years.

Research, or Manufacturing Partnerships or Alliances:
The Dow Chemical Company www.dow.com
http://opxbio.com/press/Dow_and_OPXBIO_Collaborating_on_Renewable_Route_to_Acrylic_Acid.php

MBI International www.mbi.org

- National Renewable Energy Laboratory (NREL) http://www.nrel.gov/
- Johnson Matthey Catalysts LLC http://www.matthey.com/

Stage: (Bench, pilot, demonstration, commercial)
Demonstration Stage

Website URL:
www.opxbio.com

Chief Executive Officer:
Charles R. (Chas) Eggert

Business development or sales contact:
Mike Rosenberg
VP, Business Development
OPXBIO

Product: BioAcrylic

Product Description:
BioAcrylic is a renewable form of the industrial chemical, acrylic acid. Traditionally, acrylic acid is produced from propylene, derived from petroleum.

Product Applications:
Diapers, detergents, paints and adhesives—anywhere acrylic acid is used today.

Unique Features (i.e., what separates this product from the competition, whether bio-based or incumbent fossil-based products – e.g. cost, performance features).
BioAcrylic will perform the same as petroleum-based acrylic acid but is developed from renewable feedstocks.

Feedstocks and bio-based content (e.g. “20% soy-based”)
OPXBIO’s EDGE (Efficiency Directed Genome Engineering) technology platform allows the production of a number of biochemicals and biofuels from a range of feedstocks, such as sucrose from sugarcane, dextrose from corn and syngas (carbon dioxide and hydrogen).

Wholesale or retail Product price (if applicable)
Customer Confidential
Parity price e.g. competitive with $XX oil: (if applicable, in BPOE, US$)
Customer Confidential

Website URL:
www.opxbio.com

Product: Fatty Acids

Product Description:
OPX BIO has demonstrated lab-scale production of its second product—fatty acid derived from syngas (carbon dioxide and hydrogen) via a fermentation pathway—for chemical and fuel applications. The company was awarded a $6 million grant by the U.S. DOE in April 2010 to support this development.

Product Applications:
Jet fuel, diesel fuel, shampoo, detergent and soap.

Unique Features (i.e., what separates this product from the competition, whether bio-based or incumbent fossil-based products – e.g. cost, performance features).
OPXBIO’s fermentation process uses carbon dioxide and hydrogen directly to produce fatty acids that are then chemically converted to direct replacement diesel and jet fuel. The carbon dioxide and hydrogen can be sourced from numerous diverse feedstocks such as syngas from the gasification of biomass and municipal solid waste, by-products from manufacturing processes or from more traditional sources such as natural gas or shale gas. The diversity in feedstock sources directly addresses many of the overarching issues around the liquid fuel industry today, including energy security issues, reducing imported oil, reducing greenhouse gas emissions, increasing the availability to have more renewable fuel sources and increasing energy diversity.

OPXBIO can also leverage its work on direct replacement diesel and jet fuel into the chemical market. OPXBIO will develop commercially viable fatty acids that have applications in the surfactant, detergent and other markets using hydrogen and carbon dioxide as its feedstock. This will create unique chemical products utilizing a diverse feedstock that provides flexibility in plant locations and optimization of the overall cost and economics.

Feedstocks and bio-based content (e.g. “20% soy-based”)
OPXBIO’s EDGE (Efficiency Directed Genome Engineering) technology platform allows the production of a number of biochemicals and biofuels from a range of feedstocks, such as sucrose from sugarcane, dextrose from corn and syngas (carbon dioxide and hydrogen).

Wholesale or retail Product price (if applicable)
N/A
Parity price, e.g. competitive with $XX oil: (if applicable, in BPOE, US$)
N/A

Website URL:
www.opxbio.com
OriginOil

Address:

5645 West Adams Blvd Los Angeles, CA 90016

Year founded

2007

Annual Revenues:

$45,000 (2010)

Company description:

OriginOil helps algae growers extract oil from algae for use as a feedstock for the commercial production of transportation fuels, chemicals and foods. In a single step, our breakthrough technology efficiently dewaterers and breaks down algae for its useful products, overcoming one of the greatest challenges in making algae a viable replacement for petroleum. As a pioneer and the emerging leader in the global algae oil services field, OriginOil supports its core algae extraction technology with an array of process innovations for some of the world's most successful algae growers and refiners, just as pioneers like Schlumberger and Halliburton have done in the oilfield services industry.

Major Investors (if a public company, please provide trading symbol and exchange).

OTCBB: OOIL (OOIL until 12 Sept)

Type of Technology(ies)

Low-energy, chemical-free algae dewatering and extraction

Feedstocks:

Microalgae

Products (e.g. ethanol, biobutanol, biodiesel, renewable diesel, renewable jet fuel, power, organic acids, bioplastics etc)

Algae Crude (UIF: a uniform intermediate feedstock for downstream products such as lipids and biomass)

Product Cost (if applicable - per US gallon): (Costs per US gallon for fuels, costs per
pound for chemicals and/or biomaterials. If you do not manufacture or have long-term stable feedstock pricing, please use the latest December futures contract pricing for traded feedstocks, or $55/ton for untraded biomass – or provide notes on your own feedstock pricing assumptions).

- Algae Crude (UIF): Est. opex: $0.006/kg. Est. capex: $0.006/kg. That converts to $6.00/ton. N/A

**Offtake partners** (if applicable)

Not applicable – OriginOil is a technology company.

**Past Milestones**

12 Aug 2011: OriginOil Receives Increased Order for Large-Scale Algae Extraction System
New total brings orders to $1 million for the year to date

8 Dec 2010: OriginOil Announces Successful First Phase of Commercial Pilot Program
Pilot Partner MBD Energy Praises OriginOil Team on Expertise and System Operation
10 May 2010: OriginOil Announces Its First Customer Industry leader MBD Energy intends to purchase algae feeding and extraction systems

**Future Milestones**

- Successful operation of 300 GPM continuous harvesting for industrial demonstration site in Australia
  - Full scientific and industry validation of Single Step Extraction
  - Company up-listing to a senior US securities exchange

**Business Model:** (e.g. owner-operator, technology licensor, fee-based industry supplier, investor)

Technology licensor; algae oil services

**Competitive Edge(s):**

Now in commercialization phase, OriginOil enjoys first-mover advantage in the next generation of low-energy, continuous, chemical-free algae dewatering and extraction technologies.

With its array of process innovations, OriginOil is also an early leader in the emerging algae oil services sector.

**Research, or Manufacturing Partnerships or Alliances.**
MBD Energy
Department of Energy (Idaho National Lab)
California State University Long Beach
StrategicFit
World Water Works
Desmet Ballestra
Research Institute of Tsukuba Bio-Tech
Pacific Junction (Ennesys joint venture)
Electricore
Biogas Energy
Ceramatec
Carbonomics

Stage (Bench, pilot, demonstration, commercial)

Pilot: OriginOil recently proved the ability to process as much as 15 GPM continuously, will soon deliver a production 20 GPM system, and is now building a 300 GPM system which will represent commercial scale.

Website URL

www.OriginOil.com
Oxford Catalysts Group

(includes Oxford Catalysts Ltd, based near Oxford, UK and Velocys, Inc., based in Plain City, Ohio)

Company description:

The Oxford Catalyst Group Develops of catalysts and microchannel reactor technology for the generation of clean fuels from both conventional fossil fuels and biomass

Address:

115e Milton Park, Oxford OX14 4RZ, UK

Year founded:
2001: Velocys, Inc.
2004: Oxford Catalysts Ltd.
2008: Oxford Catalysts Group

Chief Executive Officer and contact email:
Roy Lipski

Annual Revenues:

£8.6 million (year ended December 2009) ($13.5 million approximately)

Major Investors (if a public company, please provide trading symbol and exchange).

- Battelle Memorial Institute: 16.5%
- Lansdowne Partners: 16%
- Pioneer Investments 15.7%
- IP2IPO Management Limited: 8.2%
- Dr Tiancun Xiao: 6.5% (company co-founder)
- Professor Malcolm Gree: 4.9% (company co-founder)
- University of Oxford: 3.7%
- Roy Lipski: 3.6%

Type of Technology(ies):

- Fischer Tropsch (FT) microchannel reactor technologies for the efficient, economical and environmentally friendly small scale distributed production of biofuels via biomass to liquids (BTL) and liquid fuels from gas via gas to liquids (GTL)
• Microchannel reactor technology for steam methane reforming (SMR)
• Other applications for microchannel reactors, including hydrocracking, clean chemical manufacturing, homogenisation, emulsification and distillation
• Patented OMX method for the development and preparation of tailored highly active selective and stable catalysts for use in microchannel reactors and for the generation of clean fuels from other applications.

Feedstocks:

• For biofuels: a wide range of waste feedstocks including agricultural, municipal and construction waste, forestry waste
• For gas-to-liquid fuels: stranded and associated gas from oil wells which would otherwise be reinjected, vented or flared

Fuel Type (if applicable): (e.g. ethanol, biobutanol, biodiesel, renewable diesel, renewable jet fuel, power etc):

• Synthetic diesel and jet fuel from biomass waste feedstocks via BTL
• Synthetic diesel and jet fuel from stranded and associated gas via GTL

Fuel Cost (if applicable - per US gallon):
Depending on the feedstock used, the synthetic diesel and jet fuels produced are economic when oil prices are in the range of $50 – $70/barrel.

Offtake partners (if applicable)
Not currently applicable, but we are working with the Portuguese incorporated holding company SGC Energia to market the technology.

Co-products (if applicable)

• Certain cuts of the FT product can be used as high quality and high value synthetic lubricants for automotive applications.

• The process also produces high temperature steam which can be used for district heating or to assist the initial gasification stage of the process to enhance process efficiency.

• Some light organics are also produced. These can be used as chemical feedstocks or returned to the gasifier to assist in the gasification stage.

Past Milestones:

• A binding memorandum of understanding between the Thai state-owned energy
company, PTT, and the Oxford Catalysts Group. Under the terms of the MOU, PTT will provide funding of US$5 million over 2 years to support the development and commercialisation of Oxford Catalysts Group's steam methane reforming (SMR) technology.

- Joint demonstration testing agreement (JDTA) between Velocys, Inc., offshore facility developers MODEC, global engineering firm Toyo Engineering and the Brazilian State Oil Company, Petrobras to build and operate a microchannel GTL demonstration facility in Foraleza, Brazil.

- Setting up and successful running of a BTL demonstration plant jointly operated by the Oxford Catalysts Group and the Portuguese incorporated holding company SGC Energia for the small scale distributed production of biofuels via the FT reaction at the biomass gasification facility in Güssing, Austria. The demonstration plant has been fully operational and running smoothly since August 2010 and will lead to the Oxford Catalysts Group's first commercial orders.

**Future Milestones**

- Further demonstration of BTL technology in the USA and Europe
- Initial sales of commercial FT units for BTL processes (2011)
- Successful demonstration of GTL technology in Brazil (2011) and first sales of integrated GTL facilities (2012) for onshore or offshore applications

**Business Model:** (e.g. owner-operator, technology licensor, fee-based industry supplier, investor)

Technology developers and licensors

**Competitive Edge(s):**

- Catalyst development, including OMX, a patented method, for producing highly active and more stable catalysts by enabling greater control of the particle size resulting in a narrower particle size distribution of crystallites in the nanometre diameter range which exhibit terraced surfaces. Both of these features enhance catalyst activity. OMX also produces fewer very small crystallites that could sinter at an early stage of operation. This results in greater catalyst stability.

- Microchannel process technology. The Oxford Catalysts Group has the world's largest portfolio in microchannel process technology, which potentially has a very wide range of applications, including biofuels and clean fuels production (see below), hydrocracking, distillation and homogenisation.

- Biofuels and clean fuels production, including microchannel reactor technology for the small scale distributed production of biofuels via BTL, and the small scale production of
liquid fuels via SMR and GTL. Microchannel technology for hydrocracking, distillation, emulsification and homogenisation.

**Distribution, Research, Marketing or Production Partnerships or Alliances.**

- Memorandum of Understanding (MOU) between Oxford Catalysts Group and the Thai state energy company, PTT, for the development of microchannel steam methane reforming technology (SMR).

- Joint demonstration testing agreement (JDTA) between Oxford Catalyst Group member, Velocys, Inc., offshore facility developers, MODEC, Toyo Engineering and the Brazilian State Energy Company, Petrobras, to build and operate a microchannel gas to liquid (GTL) demonstration facility in Fortaleza, Brazil.

- Joint Development Agreement (JDA) between Velocys, Inc., and the Portuguese incorporated holding company SGC Energia (SGCE) to set up an FT microchannel reactor demonstration plant at the biomass gasification facility in Güssing, Austria. SGCE will place first orders for microchannel FT reactors on completion of the technical milestones during this demonstration.

**Stage** (Bench, pilot, demonstration, commercial)

Some of the technologies are under development (distillation, clean chemicals, homogenisation), some (BTL and GTL) are at, or approaching, the demonstration stage. Emulsification technology is at the commercial stage, and BTL technology is close to commercial.

**Website URL**

www.oxfordcatalysts.com
www.velocys.com
Parabel

Company description:

Parabel is a renewable energy company currently licensing and deploying the leading biomass production platform to address existing and growing unmet needs in the global energy and agriculture markets. Our proprietary technology, consisting of light and environmental management systems, allows our customer licensees to grow aquatic microorganisms at a rate that consistently exceeds natural growth rates. This enables the commercial-scale production of two end-Products: a fuel feedstock, which we refer to as our biocrude, and protein products. The fuel feedstock is intended to be used principally in existing refineries, resulting in renewable fuels which are functionally compatible with the petroleum-based fuels they would replace. The high productivity afforded by our technology leads to fuel feedstock which should increase the profitability of the refineries without the requirement for any government subsidies.

Address:

1901 S. Harbor City Blvd, Ste 300, Melbourne, FL 32901

Year founded: 2006

Type of Technology(ies)

Our proprietary technology, consisting of light and environmental management systems, allows our customer licensees to grow aquatic microorganisms at a rate that consistently exceeds four times the natural growth rates. This enables the commercial-scale production of two end-Products: a fuel feedstock, which we refer to as our biocrude, and protein products. The fuel feedstock is intended to be used principally in existing refineries, resulting in renewable fuels which are functionally compatible with the petroleum-based fuels they would replace. The high productivity afforded by our technology leads to low cost fuel feedstock which should increase the profitability of the refineries without the requirement for any government subsidies.

Feedstocks:

Biocrude

Fuel Type

Fuels that can be produced from the biocrude feedstock include renewable diesel, renewable jet fuel, and renewable gasoline. Also the feedstock can be used in combustion
processes.

**Fuel Cost (if applicable - per US gallon):**

For our customer licensees engaged in the energy market, the value of our protein product offsets the cost of production, resulting in biocrude produced at a low marginal cost. As a result, we believe that the end-products produced by the licensees of our technology and processes will remain commercially viable even with crude oil prices as low as $20 per barrel. The profitability of our license units is not dependent on government subsidies or historically high oil prices.

**Offtake partners (if applicable)**

Currently Parabel has several offtake partners. Details are protected under NDA.

**Co-products (if applicable)**

Parabel technology ultimately creates two end-products: a fuel feedstock and a protein, which we refer to as our biocrude and protein products.

**3 Top Past Milestones**

- During 2009, we developed our proprietary remote sensing system (consisting of multi-spectral cameras and imaging algorithms) that enables us to measure micro-crop density. In addition, during that time we identified the approximately 150 micro-crop species that are most suitable for our processes from among over 5,000 species that could be used for the commercial generation of biomass.

- In 2009, we entered into an MOU with Foster Wheeler for the purpose of developing and co-marketing end-to-end market solutions for the large-scale production of green renewable gasoline, diesel and jet fuel in existing petroleum refineries.

- During 2009 and 2010 (to date), we have signed MOUs with five prospective customer licensees representing up to 18 license units.

- In June 2009, we completed our working demonstration facility consisting of two full-scale bioreactors (approximately one hectare each) that display our technology and processes and demonstrate the micro-crop yield that each bioreactor can generate.

- In November 2009, the Indonesian Ministry of Agriculture cleared our protein product as an approved raw material for use in animal feed. We are in the process of obtaining additional animal feed approvals in nine other jurisdictions.
Future Milestones

Unable to make forward looking statements.

**Business Model:** (e.g. owner-operator, technology licensor, fee-based industry supplier, investor)

Parabel’s primary business model is to license this technology to large customers who will commercially produce biomass, which in turn is processed into two co-Products: (1) renewable fuel feedstock, and (2) protein for supplementation of animal feed and potentially human food ingredients.

**Competitive Edge(s):**

Parabel Location the production of renewable fuels through photosynthesis and we have a currently commercially viable system to address the commodity fuel and food markets based on this approach. Many companies are focusing their efforts on the higher value but smaller specialty chemical or nutraceutical markets which do not require the same volumes of biomass to be economic. Some of our competitors are using genetically modified or selectively-bred organisms that are designed to encourage certain properties (such as high lipid production). Microorganisms that produce high concentrations of lipids produce lower amounts of protein and carbohydrates. Parabel’s approach uses indigenous species exclusively and promotes optimal growth. The resultant organisms produce a high proportion of valuable protein that is part of the success of our business model.

**Distribution, Research, Marketing or Production Partnerships or Alliances.**

**Foster Wheeler AG**
Parabel has signed a Memorandum of Understanding with Foster Wheeler AG’s (Nasdaq: FWLT) Global Engineering and Construction Group for engineering services to be performed in conjunction with Parabel’s micro-crop technology, which allows for the production of dry biomass at an unprecedented scale. Parabel intends to work with Foster Wheeler to develop commercial solutions that will allow existing oil refineries to convert micro-crop biomass into fuels that are functionally compatible with petroleum-based fuels in the current market. For refineries, the solutions are expected to provide strong economics from the large-scale processing of Parabel’s micro-crop biomass into green fuels. The two firms will create end-to-end market solutions for the large-scale production of green gasoline, diesel, jet fuel and specialty chemicals.

**Stage** (Bench, pilot, demonstration, commercial)

Parabel is beyond demonstration stage. Our “commercial demonstration facility” was completed in June 2009 and has been in continuous operation since then. Parabel has
signed initial agreements with commercial intent.

Website URL

www.Parabel.com
Petrobras

Based in:

Brazil

Business:
Oil and gas producer with sugarcane ethanol and biodiesel operations.

Model:
State-owned operator. Announced that it was not seeking to acquire distressed ethanol companies but would establish partnerships where appropriate to support development of the national ethanol industry. According to Petrobras management, the state oil giant would offer a guaranteed ethanol contract over 10 years in return for a minority stake in a project. Local developers would hold the majority interest.

Past milestones:

In November, Toyota’s trading company, Toyota Tsusho established a joint venture with Taiwan’s China Man-Made Fiber Corp, Greencol Taiwan with an initial capitalization of USD $123 million. Greencol will import sugar cane based ethanol from Braskem in Brazil, to produce mono ethylene glycol, a precursor to PET plastic.

In October, Petrobras agreed to a $1.2 billion deal to buy as much as 580 million gallons of ethanol from Açucar Guarani during the next four years. Petrobras already agreed at the end of April to buy 45.7% of the company from its French parent Tereos over the next five years.

In August, KL Energy and Petrobras announced that they have entered into a Joint Development Agreement to jointly optimize BLUE SUGARS’s proprietary cellulosic ethanol process technology for sugarcane bagasse feedstock. As part of this agreement, The companies also said that they will develop a 4 Mgy bagasse-based cellulosic ethanol project that will be co-located with a Petrobras-owned sugarcane mill, which will come online in 2013.

In addition, Petrobras will provide $11 million to adapt BLUE SUGARS’s demonstration facility to the use of bagasse, validate the optimized process by producing cellulosic ethanol and lignin and license the validated technology. The agreement has an initial term of 18 months and provides for mutual exclusivity in the area of developing cellulosic ethanol from bagasse. The latest generation of BLUE SUGARS’s process design provides for substantial enhancements over the first generation, implemented in 2008 at the company’s demonstration plant in Upton, Wyoming using Ponderosa Pine feedstock, including the
ability to be optimized for multiple feedstocks.

Also in August, Petrobras confirmed that it has acquired a 50 percent stake in biodiesel producer Bioleo Industrial e Comercial, for $8.8 million.

According to Petrobras, “Bioleo is an oil extraction plant located in Bahia state, with capacity to process 130,000 tons (37 Mgy) of grains of several types of oilseeds. The unit has installed capacity to store 30,000 tons of grain and tankage for 10 million liters of oil.” The company said that it would utilize proceeds from the investment for operational and safety upgrades at the facility.

In July, Petrobras and BIOeCON announced a partnership in the joint development of a process for conversion of sugarcane bagasse into chemicals, green plastics, or advanced biofuels. The new technology, called BiCHEM (Biomass Chemical Conversion), was developed by BIOeCON together with a team of top class scientists from Delft University of Technology in the Netherlands and the Universidad Politecnica of Valencia in Spain. BiCHEM technology uses a recyclable inexpensive solvent to dissolve a significant part of biomass. In such homogeneous phase, cellulose and hemicellulose are quickly converted to its simplest, sugar constituents. Those sugars are further hydrogenated and then finally converted to the chemicals of interest, which can be easily separated from the recyclable solvent. The approach allows to use the biomass to its fullest by converting all the carbon available in cellulose and hemicellulose to products and using much less energy.

In May, Petrobras and Portugal’s Galp Energia announced a plan to invest up to $530 million to produce 300,000 metric tons of palm oil in Brazil and 250,000 tons of biodiesel in Portugal, starting in 2015. The palm oil will be used as feedstock for the biodiesel, which will be distributed in Europe. Each partner will invest half of the capital needed for the project.

The project is another in a series of joint ventures, mergers and consolidations in the Brazilian sugar and renewables sector since the 2008 global financial crisis toppled the credit structure of the renewables industry. Earlier in May, Petrobras took a 46 percent stake in Brazil’s fourth largest ethanol group, Acucar Guarani (ACGU3.SA) for $920 million from France’s Tereos.

Gabrielli said that "We are not only expanding our position in the ethanol market within Brazil. We want to be a big player in the international ethanol market. Right now we have a joint venture in Japan with a Japanese company that involves developing a business model to increase the ethanol market there. We own 87 percent of a refinery in Okinawa and we already sell gasoline blended with ethanol in Japan. We plan to use our facilities in Japan to be an important hub in the ethanol business of that nation."

Petrobras Biocombustivel CEO Miguel Rossetto said that the Brazilian state oil giant has targeted $2 billion in biodiesel and ethanol investment through 2013, and aims to achieve
a 15 percent share of the Brazilian ethanol market and up to 25 percent market share in biodiesel.

Petrobras and Camargo Correa have combined their pipeline building efforts into a single entity, PMCC, that will link Uberaba in Minas Gerais to the sugarcane processing center of Paulinha in Sao Paulo state, and then to ports and export terminal in Sao Sebastiao and Ilha d'Agua. The pipeline is expected to commence operation in 2010, will be fully completed in 2012, and will transport up to 3.17 billion gallons of ethanol per year. The project cost is expected to reach $1.5 billion and will transport up to 40 percent of ethanol production from Brazil’s southern region.

**Future milestones**: Petrobras Biocombustivel has previously announced plans to invest $475 million in the biofuels sector in 2009, and become a top 5 global biofuel producer by 2020 with a total investment program of $2.8 billion between 2009 and 2013.

Has entered into talks of partnership and/or investment with Brenco, the Brazilian ethanol producer that counts AOL founder Steve Case, Vinod Khosla and Bill and Hillary Clinton among its direct and indirect investors. Brenco said that it may sell a controlling stake to Petrobras, or merge with ETH Bioenergia, the ethanol company founded and controlled by Odebrecht.

**Metrics**: Petrobras, which has set a goal of 500 Mgy in ethanol exports by 2013, said it will invest $2.5 billion in ethanol development through 2013, with another $800 million dedicated to biodiesel. Set a company $174.4 billion five-year business plan based on a baseline projection of $65+ oil.
Phycal

Address: 51 Alpha Park, Highland Heights, OH 44143

Year founded: 2007

Type of technology:
Phycal is developing an integrated production system based on its patent pending technologies for growing algae and extracting energy products, primarily algal oil. Phycal is focused on delivering energy products at a market-competitive price. Algal oil can be converted into biodiesel, or refined into renewable, drop-in replacements for diesel, jet fuel, and feedstock for other energy products.

Phycal’s core technologies include:

1. Olexal® Non-destructive extraction ("milking") of oil from algae.

Phycal’s patent-pending non-destructive extraction process, Olexal®, milks the oil from algae while maintaining their viability. The “milked” algae are recycled to the ponds to grow more oil. Olexal® requires no dewatering, kills competitors and contaminants, and increases both biomass productivity and lipid accumulation.

2. Heteroboost™, a hybrid 2-stage phototrophic (sunlight & CO₂) and heterotrophic (fixed carbon) system for optimum economic yield of oil from algae.

Phycal’s production system also deploys the patent-pending Heteroboost™ technology. It starts with a phototrophic first stage to grow biomass and lipid to optimum levels with sunlight and CO₂ and then moves algae to a heterotrophic second stage which provides fixed carbon (e.g. inedible sugar) to the algae that quickly and dramatically boosts oil and biomass. This hybrid system synergistically combines the benefits of what is achievable through purely phototrophic or heterotrophic growth.

Fuel Type:
Phycal produces commodity energy products from algae, primarily algal oil, as a feedstock for partners who will convert Phycal's algal oil to renewable diesel, biodiesel, renewable jet fuel, and renewable naphtha.

Major investors:
Logos Energy, Inc.

Past milestones:
1. In June 2008, the company opened their subpilot-scale plant. This subpilot was built to
scale-up all unit operations from laboratory-scale to the next technology readiness level. At the subpilot technology readiness level, the goal is to scale-up, develop, and integrate all unit processes into a continuous system in a relevant environment.

This is the last level necessary before implementation at the pilot/demonstration level. To achieve this, Phycal has to date installed and developed: outdoor ponds, 3 prototype iterations on Olexal® non-destructive extraction unit, 2 prototype iterations on Heteroboost™ hybrid growth system, a low-cost primary dewatering process, an aqueous extraction process, a water treatment process, a distillation process, and process logic controls. Phycal submitted multiple patent applications as a result of this subpilot development. In October 2009, Phycal constructed the first pilot-scale skid-mounted Olexal and Heteroboost units for shakedown and preparation for pilot installation.

2. In June 2008, the company completed a preliminary design and executed a lease for a 30+ acre pilot site in Hawaii. This pilot will be capable of 100,000+ gallons of algal oil per year. As part of the pilot, the State of Hawaii has committed cost share. Collaboration was secured with potential customer and customer's customer.

3. In September 2009, the company delivered algal oil under an Air Force contract.

Future milestones:

1. Raise funds for pilot plant and operations in Hawaii with combination of federal and state awards and venture capital.

2. Construction, commissioning, and commencement of pilot plant operations in Hawaii.

3. Verify that pilot plant operating parameters meet cost model assumptions for $4/gal algal oil.

Business model:

Phycal will partially own and operate project-financed commercial algal oil production facilities. The company may also choose to license unit processes.

Fuel cost:

Target cost for first commercial facility in Hawaii is $4 per gallon of algal oil by 2016 with natural algae, without an operating subsidy, and including an adequate return to capital. Rollout of follow-on farms in contiguous U.S. will drive to $1-2 per gallon with transgenic algae and continuous improvement.

Competitive edge:

Phycal's primary differentiators and competitive edge are from the access and development of breakthrough technology and a culture of execution. Both the Olexal® non-destructive extraction technology and Heteroboost™ growth system fundamentally change the
production of algal oil. See their value propositions in tables below. The tremendous advantages of Olexal and Heteroboost can only be realized if successfully executed. Phycal has built an execution culture based on the integration of scientists and engineers.

Working together provides broad perspectives where the biology and system-wide implications are understood so that knowledge is deployed quickly.

Table 1 - Value Proposition of Olexal

<table>
<thead>
<tr>
<th>Direct Advantages</th>
<th>Indirect Advantages</th>
<th>Commercial Advantages (i.e. How Olexal reduces CapEx and OpEx)</th>
</tr>
</thead>
</table>
| The recycling of viable algae back to ponds after lipid milking to grow more lipids | • Decouples production of oil from production of biomass (i.e., do not need to grow more biomass to grow more oil)  
• Energy, nutrients, and CO₂ go more directly to oil production instead of algal cell production  
• Allows continuous algal oil production instead of traditional batch processing which reduces inoculum and grow-up space and time  
• Oil extraction can begin in inoculum ponds thus converting into active area  
• Increases overall system efficiency and benefits energy balance | • Reduced nutrient supply chain and pumping of CO₂  
• Reduced land requirement and greater percentage of land is active area |
| Eliminates or reduces dewatering                                                  | • Reduces system complexity  
• Reduced dewatering chemicals that must be handled up- and downstream | • Eliminates or reduces costs of an entire unit process |
| The removal of chemical algal growth inhibitors (i.e. algal waste)               | • Algae cannot signal to each other that they are too “crowded”  
• Higher culture densities  
• Increased both biomass and lipid productivity. | • Higher return to capital for ponds  
• Reduced land requirement |
| The reduction or elimination of algal predators and competitors                  | • Dramatically reduces risk of culture crash  
• Extends open pond production for many weeks instead of a few days  
• Decreases amount of inoculum  
• Reduces both scheduled and unscheduled downtime  
• Increases Overall Equipment Effectiveness | • Reduced land requirement because of reduced inoculum  
• Higher return to capital for ponds |
Extracts only non-polar lipids and not impurities (e.g. chlorophyll, gums, phospholipids) • Higher quality product • Reduces purification burden • Lower purification costs

Table 2 - Technical Value Proposition of Heteroboost™ Technology

<table>
<thead>
<tr>
<th>Direct Advantages</th>
<th>Indirect Advantages</th>
<th>Commercial Advantages (i.e. How Heteroboost reduces CapEx and OpEx)</th>
</tr>
</thead>
<tbody>
<tr>
<td>The use of phototrophically grown biomass as a feedstock to rapidly produce additional lipid and biomass heterotrophically</td>
<td>• Decouples production of oil from phototrophic production of biomass (i.e., do not need to grow more biomass to grow more oil) • Fixed carbon provided goes more directly to oil production instead of algal cell production • Increased both biomass and lipid productivity • Increases overall system efficiency and benefits energy balance</td>
<td>• Reduced land requirement and greater percentage of land is active area • Increased oil production from fixed set of biomass</td>
</tr>
<tr>
<td>Modify the lipid profile of the algal strain by metabolism shift</td>
<td>• Algae appear to use different metabolic pathways for lipid production under heterotrophic growth allowing selection of different lipid end products • Different carbon sources provide different end products</td>
<td>• Higher value lipid product of better product specifications for customer satisfaction • Flexibility in the production system to tailor end products to customer use</td>
</tr>
<tr>
<td>Ability to use fixed carbon from inexpensive sources such as lignocellulosic industry</td>
<td>• Take advantage of the rapidly developing lignocellulosic industry as it develops sugars targeted to ethanol production • Offer an alternative fuel for producers of lignocellulosic derived sugars to ethanol that is more energy dense (and a direct drop in for current fuels). • Potentially provide more bang for the buck from lignocellulosic sugars as they are shuttled via respiratory metabolism to useful end products (vs. fermentative pathways for ethanol).</td>
<td>• Lower cost fixed carbon sources • Provide flexibility to lignocellulosic sugar producers.</td>
</tr>
</tbody>
</table>
Stage:

Currently at subpilot. Pilot will be operational in 2010 at 100,000+ gallons of algal oil per year.

Website URL.

www.phycal.com
POET

Address: 4615 N. Lewis Ave., Sioux Falls, S.D. 57104

Year founded  1987

Company description: POET, the largest ethanol producer in the world, is a leader in biorefining through its efficient, vertically integrated approach to production. The 23-year-old company produces more than 1.7 billion gallons of ethanol and 10 billion pounds of high-protein animal feed annually from 27 production facilities nationwide. POET also operates a pilot-scale cellulosic ethanol plant, which uses corn cobs, leaves, husk and some stalk as feedstock, and will commercialize the process in Emmetsburg, Iowa. For more information, visit http://www.poet.com.

Major Investors -10,000 farmer investors in individual plants; POET, LLC.

Type of Technology(ies): Cellulosic ethanol conversion (enzymatic hydrolysis), Grain ethanol conversion (raw starch hydrolysis – BPX cold-cook process)

Feedstocks: corn, corn stover

Products (e.g. ethanol, biobutanol, biodiesel, renewable diesel, renewable jet fuel, power, organic acids, bioplastics etc): grain ethanol, cellulosic ethanol (pilot scale), DDGS, zein, carbon dioxide (beverage markets), corn oil

Product Cost (if applicable - per US gallon): (Costs per US gallon for fuels, costs per pound for chemicals and/or biomaterials. If you do not manufacture or have long-term stable feedstock pricing, please use the latest December futures contract pricing for traded feedstocks, or $55/ton for untraded biomass – or provide notes on your own feedstock pricing assumptions).

Offtake partners (if applicable) POET is an integrated company. Ethanol is marketed by POET Ethanol Products, DDGS and other co-products by POET Nutrition.

Past Milestones:
1. Cellulosic ethanol advancement (Project LIBERTY):
   - technology ready for commercial scale
   - received conditional commitment for $105 million loan guarantee from Department of Energy (2011) for Project LIBERTY construction
   - first commercial-scale biomass harvest of 56,000 tons for cellulosic ethanol in Emmetsburg, Iowa (2010-2011)
   - started construction with a 22-acre biomass stackyard at Project LIBERTY site with
continuing work this fall.

2. Developed new Products:
   • branded zein product “Inviz™,” which can be used as a gum base or in films, packaging, adhesives, coatings, glazes and more.
   • branded corn oil “Voila™,” which is being sold to biodiesel producers. Plan to install technology to all 27 plants, with a potential of enough corn oil to supply feedstock for 50 million gallons of biodiesel per year.

3. Green technology
   • Total Water Recovery in 18 POET plants, which has reduced overall water use by more than 650 million gallons of water per year over 2009 baseline. Company-wide average water use per gallon of ethanol now at 2.6
   • Waste heat recovery system saves energy in POET Biorefining – Caro. POET also has three plants using Combined Heat and Power processes
   • landfill gas and a solid-fuel boiler at POET Biorefining – Chancellor replaces natural gas

Future Milestones
1. Startup of POET’s first commercial-scale cellulosic ethanol plant, Project LIBERTY, a planned 25 million-gallon-per-year plant that uses corn cobs, leaves, husks and some stalk to produce cellulosic ethanol and biogas.

2. Reduce water use to 2.33 gallons of water per gallon of grain-based ethanol produced. Continue to reduce greenhouse gas intensity and sustainability of grain-based ethanol production.

3. Expansion of existing co-products and continued development of new bioproducts to displace those made by petroleum.

Business Model: (e.g. owner-operator, technology licensor, fee-based industry supplier, investor) owner-operator

Competitive Edge(s): Vertically integrated system, large network of plants provides shared knowledge of process efficiencies, millions spent annually on research leads to breakthroughs each year in every step of the process.

Research, or Manufacturing Partnerships or Alliances. POET works with a wide variety of universities, government agencies and private companies.

Stage (Bench, pilot, demonstration, commercial) 27 grain-based ethanol plants, 1 pilot-scale cellulosic ethanol plant, planned commercial cellulosic ethanol plant for startup in 2013.

Website URL: www.poet.com
**Praj Industries**

**Based in:**
Praj House, Bavdhan, Pune – 411021. India

**Year founded:**
1984

**Type of Technology**

Fermentation, Distillation, Dehydration, Evaporation, waste-water treatment and re-utilization, for first generation bioethanol and esterification, trans-esterification, technologies for biodiesel plants.

Second and Third generation under pilot-scale and lab scale respectively.

**Type of fuel**

Turnkey solutions to install plant and equipment to produce bioethanol and biodiesel from 1st and 2nd generation energy crops

**Past milestones:**

1. Inaugurated Lignocellulose to Ethanol pilot plant

2. Inaugurated first-of-its-kind zero discharge wastewater plant wherein Praj supplied its patented self cleaning, extended operation evaporation system.

3. Energy efficient ethanol plants in Europe for Biowanze, Belgium and Anklam Biofuels, Germany.

**Future milestones:**

1. To offer alternate, low carbon footprint, Farm-to-Fuel modules for biofuels
2. To achieve critical milestones in Lignocellulosic biomass to ethanol production
3. To establish a Pilot plant for algae to biodiesel

**Business Model**

Complete services under one roof for biofuel plants

**Competitive edge**

Technology, experience, own manufacturing units, global presence and R & D
backed solutions

**Distribution**
Praj is operating across 5 continents with over 450 references

**Stage**
Praj offers entire solutions right from concept to commissioning – for installing biofuel comple

**Website**
www.praj.net
Propel Fuels

Based in:
California

Business:
Biofuel retailer.

Model:
Owner-operator.

Past milestones:

Launched an improved version of its CleanDrive personal and fleet carbon emission reduction tracking platform. The application supports users tracking emissions benefits from biofuels usage for personal reasons, as well as those tracking emissions benefits for governmental reporting efforts, such as compliance with California’s 2020 Targets. The application also supports the future monetization of emissions reductions in carbon trading markets. The technology includes a widget that can be added to a company website or MySpace page.

Hired Matt Horton, principal of venture capitalist @Ventures, as CEO of the company, replacing Rob Elam who will remain as President. Propel has E-85 ethanol and B-5 biodiesel pumps at five gas stations in Sacramento, Rocklin, Citrus Heights and Elk Grove. It also has biofuels pumps at six stations in Washington.

Future milestones:

In 2009, new Propel Biofuels CEO Matt Horton confirmed that the company intends to build as many as 500 renewable fuel stations throughout the state of California. The company recently relocated to California from Seattle and opened five biofuels stations in the Sacramento area.

Propel Fuels intends to do so by striking up a partnership with Enterprise Rent-A-Car to fuel Enterprise’s rental cars in the Sacramento area with renewable E85 Flex Fuel. Enterprise has 73,000 flex-fuel vehicles nationally. Twelve Sacramento Enterprise locations have been selected to participate in the pilot program served by Propel's five Clean Fuel Points in the Sacramento area that serve E85 as well as biodiesel. Clean Fuel Points accept major credit and fleet cards and are open 24/7 offering convenience to Enterprise customers.
Renewable Energy Group

Renewable Energy Group is North America’s largest biodiesel manufacturer and marketer. Utilizing an integrated supply chain model, Renewable Energy Group is focused on converting triglycerides into advanced biofuels. With more than 180 million gallons of owned/operated annual production capacity REG® is a proven partner in the distillate marketplace.

Address:
416 S. Bell Ave, Ames IA 50010

Founded:
Biodiesel business dates to 1996; Renewable Energy Group was incorporated in 2006 as a spin-off of its predecessor company, West Central.

Major Investors
• West Central and affiliated entities
• Natural Gas Partners
• US Renewables Group • Bunge North America, Inc.

Type of Technology(ies)
Integrated biorefinery process technology

Feedstocks:
• Commercialized: Animal fats (pork, beef, poultry), Inedible corn oil, Used cooking oil, Vegetable oils (soybean, canola)
• Development/Research State – Algae, Camelina, Jatropha

Fuel Type:
Biodiesel

Fuel Cost (if applicable - per US gallon):
REG-9000™ branded biodiesel is competitively priced with diesel fuel. REG utilizes a feedstock- plus pricing model with index, long-term supply and volume contract options in addition to spot pricing.

Off-take partners (if applicable)
Specific customer information is confidential. Our domestic marketing focuses on
petroleum refiners and importers (obligated parties) and petroleum distributors including retail fueling entities such as travel centers. In addition, we market to several direct-use segments such as underground mining, national fleets, electric power generation and the emerging Bioheat market.

Co-products (if applicable)
- Glycerin (three grades)
- Free fatty acid
- Soapstock
- Oleolipids

3 Top Past Milestones

Completed 2012 IPO.

1. Consolidated leading position in biodiesel industry.
   a. Central Iowa Energy, LLC (February 2010) SEC 8-K filing:
      http://www.sec.gov/Archives/edgar/data/1463258/000119312510055490/d8k.htm
   b. Blackhawk Biofuels, LLC (February 2010) SEC 8-K filing:
      http://www.sec.gov/Archives/edgar/data/1463258/000119312510047926/d8k.htm
      http://www.sec.gov/Archives/edgar/data/1463258/000119312510084432/d8k.htm
   d. Tellurian Biodiesel, Inc. (July 2010) e. American BDF (a joint venture of Golden State Foods, Restaurant Technologies Inc. and Tellurian Biodiesel) (July 2010) e. ARES Corporation’s Clovis New Mexico 15 MGY biodiesel facility (Sept. 2010), which included an $8mm strategic investment by ARES SEC 8-K filing:
      http://www.sec.gov/Archives/edgar/data/1463258/000119312510200497/d8k.htm

2. Awarded multi-month contract for B100 with Hawaiian Electric Power Cooperative to fuel electric power generation

3. Published “Feedstock and Biodiesel Characteristics Report” available for industry use and download outlining the conversion of more than 30 commercial and novel feedstocks into ASTM specification biodiesel. Approx. 5,000 downloads to date.

Future Milestones
1. Expand into additional renewable fuels and renewable chemicals markets
2. Build upon market leadership through strategic acquisitions of existing biodiesel plants
3. Complete the 60 MGY REG New Orleans facility as fully integrated biorefinery
4. Raise growth-oriented capital
5. Expand current pilot algae to fuel/chemical to small scale demonstration

Business Model:
Producer and marketer of renewable fuels and chemicals

Competitive Edge(s):

- Processing technology resulting in advanced fuel quality
- Nationwide marketing distribution
- Industry collaboration and partnership
- Experienced and expert management team

Distribution, Research, Marketing or Production Partnerships or Alliances

As largest biodiesel producer and marketer in North America, with a well established reputation for quality and reliability, REG sees significant growth opportunity fueled by the implementation of RFS2. REG leads the industry in its U.S. biodiesel distribution network having sold biodiesel in every state except Alaska. REG is able to process the widest array of commercially available feedstocks and has aggressively converted the majority of its biodiesel production assets into waste feedstock biodiesel facilities. REG has also partnered with low cost waste feedstock providers to provide large, consistent, reliable volumes of waste feedstock, which is indexed to the energy markets rather than the agricultural markets, enabling REG to more effectively manage commodity risk for itself and its customers.

Research • General Atomics DARPA Algae-to-Jet Fuel Project Team Member • Battlefield Clutter: Waste-to-Energy Program through General Atomics • Locomotive biodiesel engine performance testing in collaboration with Interstate Railroad and Kansas University

Stage
Renewable Energy Group is the largest commercial producer of biodiesel in North America. We are also a partner/commercialization vehicle for new fuels and renewable chemicals being developed by others.

Website URL:
www.regfuel.com
Renmatix

Address: 660 Allendale Road, King of Prussia, PA 19406

Year Founded: 2007

Company description: Renmatix is the leading manufacturer of bio-based sugar intermediates, an alternative to petroleum derivates used in the global chemical and fuels markets. The company’s proprietary Plantrose™ process challenges conventional sugar economics by cheaply converting cellulosic biomass – from wood waste to agricultural residue – into useful, cost-effective sugars. Renmatix’s supercritical hydrolysis technology deconstructs non-food biomass an order of magnitude faster than other processes and enhances its cost advantage by using no significant consumables. Renmatix is privately held, with operations in Georgia (USA) currently capable of converting three dry tons of cellulosic biomass to Plantro™ sugar per day, and a world-class technical center in Pennsylvania (USA). For more information, visit www.renmatix.com.

Major Investors (if a public company, please provide trading symbol and exchange).
Blue Sugar
inner Perkins Caufield & Byers
BASF (BAS:Xetra)
Waste Management (WM: NYSE)

3 Top Milestones for 2010-12

• Raised $75M in Series C from strategic investors BASF and Waste Management as well as new and existing venture investors
• Entered formal JDA with Waste Management to explore post-consumer urban waste as a feedstock for the Plantrose process; initiated revenues
• Opened new world class R&D facility and relocated headquarters in King of Prussia, PA (full time staff grew 152% since January 2011)

3 Major Milestone Goals for 2013-15

• Open commercial-scale operations for large-scale production of cellulosic sugars
• License the Renmatix technology for application in new markets globally
• Expand feedstock portfolio for Plantrose™ process beyond initial materials

Business Model: (e.g. owner-operator, technology licensor, fee-based industry supplier, investor)

Owner-operator; will license technology for some markets

Competitive Edge(s): Renmatix produces the lowest-cost cellulosic sugars from a variety of feedstocks. Its Plantrose™ process uses water at elevated temperatures and pressures to break down biomass in seconds, rather than hours, and without any significant consumables. With low operating and capital costs, Renmatix will be competitive with corn
and cane sugar at its first commercial facility.

**Research, or Manufacturing Partnerships or Alliances.**

**Stage** (Bench, pilot, demonstration, commercial)
Current operating facilities include:
• Pilot – capacity of 100 kg dry biomass to sugar per day
• Demonstration – capacity of 3 dry tons of biomass to sugar per day
• Commercial – commence commercial scale production, in one or more selected locations, 2014-2015

**Website URL:** [www.renmatix.com](http://www.renmatix.com)

**Chief Executive Officer:** Mike Hamilton
Rentech

Address: 10877 Wilshire Blvd. Suite 600, Los Angeles, CA 90024

Year founded 1981

Company description:

The Company's Rentech-SilvaGas and Rentech-ClearFuels biomass gasification process can convert multiple biomass feedstocks into synthesis gas (syngas) for production of renewable fuels, power and chemicals. Combining the gasification process with Rentech's unique application of syngas conditioning and clean-up technology and the patented Rentech Process based on Fischer-Tropsch chemistry, Rentech offers an integrated solution for production of synthetic fuels from biomass.

The Rentech Process can also convert syngas from fossil resources into ultra-clean synthetic jet and diesel fuels, specialty waxes, and chemicals. Final product upgrading and acid gas removal technologies are provided under an alliance with UOP, a Honeywell company. Rentech is developing projects and offers licenses for these technologies for application in synthetic fuels and power facilities worldwide. Rentech Energy Midwest Corporation, the Company's wholly-owned subsidiary, manufactures and sells nitrogen fertilizer products including ammonia, urea ammonia nitrate solution and liquid and granular urea in the Mid Corn Belt region of the central United States.

Major Investors
Rentech has been publicly traded since 1991. Our stock trades on the NYSE AMEX under the symbol RTK. Our largest institutional holders are BlackRock Institutional Trust Company, Vanguard Group, Inc., Black Investment Management (UK) and Wellington Management Company.

Type of Technology(ies)
Biomass Gasification:
Rentech-SilvaGas biomass gasification process is a patented, commercially proven gasification technology with over $100 million invested in technology and assets. The gasifier can process a wide variety of cellulosic feedstocks to produce syngas. The syngas can be used to produce renewable power or it can be processed through our Rentech Process to produce drop-in, certified, renewable fuels. The gasifier has successfully operated in Burlington, VT for over 2 years in partnership with the Department of Energy (DOE), National Renewable Energy Laboratory (NREL) and Battelle Columbus Laboratory.

The Rentech-ClearFuels biomass gasification technology produces hydrogen as well as syngas from cellulosic feedstocks through the use of a High Efficiency Hydrothermal Reformer (HEHTR). The Rentech-ClearFuels biomass gasification technology is very
flexible and versatile which integrates easily and efficiently with other advanced biofuel technologies. The syngas can be used to produce renewable power or be processed through Rentech’s technology to produce renewable drop-in fuels. The Rentech-ClearFuels technology has operated at pilot scale in excess of 10,000 hours and multiple third parties including, Idaho National Laboratory and Hawaii Natural Energy Institute have independently validated the results of the pilot scale data. The HEHTR operating temperature is also below ash softening temperatures, which avoids slagging/fouling concerns. The gasifier will be demonstrated at our PDU facility by the end of 2011.

Syngas Cleanup: Rentech has novel and patent-pending technologies for the cleanup of syngas required for the production of synthetic fuels from biomass-derived syngas.

Synthetic Fuels: The Rentech Process can convert syngas from fossil resources into hydrocarbons which can be processed and upgraded into ultra-clean synthetic jet and diesel fuels, specialty waxes and chemicals. Rentech’s $85 million Product Demonstration Unit in Colorado produces 10 barrels per day of certified synthetic jet and diesel fuels.

Feedstocks:
The Company’s Rentech-SilvaGas biomass gasification process has been demonstrated to produce syngas from biomass feedstocks such as wood waste, green waste, agricultural waste, refuse derived waste, straw, switch grass and energy crops. The wide range of feedstocks acceptable by the gasifier will allow it to be used in a wide variety of applications today and in the future.

Our Rentech-ClearFuels’ biomass gasification technology has been demonstrated to produce syngas from virgin biomass feedstocks such as wood wastes, sawdust, bark, sugarcane bagasse, rice hulls and straw, corn stover and other clean biomass. Unlike biochemical processes, the primary driver is carbon in any form, with no difference in lignin, cellulose, or hemicelluloses.

Rentech’s Fischer-Tropsch process can process syngas derived from any carbon-bearing feedstock such as biomass, municipal waste and natural gas into hydrocarbons which can be processed and upgraded into ultra-clean synthetic jet and diesel fuels, specialty waxes and chemicals.

Products

Drop-in clean synthetic fuels: Rentech produces drop-in synthetic diesel fuel that meets ASTM-975 specs. Rentech’s synthetic jet fuel has been certified by the FAA for commercial aviation use and by the U.S. Air Force for use in its aircraft. All fuels produced by the Rentech Process can be distributed and used in existing infrastructure including pipelines and engines and are cleaner burning than traditional petroleum-derived fuels. Rentech's
ultra low sulfur diesel fuel, or RenDiesel, is environmentally friendly. RenDiesel is biodegradable, exceeds all global sulfur requirements and has no aromatics.

When compared to traditional petroleum-derived low sulfur diesel, tailpipe emissions from RenDiesel generate lower amounts of hydrocarbons, carbon monoxide, particulate matter, nitrogen oxides (NOX), sulfur oxides (SOX) and carbon dioxide. Also, when compared to traditional diesel fuels, RenDiesel has higher hydrogen content, heating value and cetane index, making it very energy efficient. RenDiesel also has excellent storage stability making it an ideal fuel for back-up power generators.

Renewable RenDiesel reduces greenhouse gas emissions on a lifecycle basis by as much as 97% over conventional diesel fuel and by a comparable amount over electric vehicles. A vehicle using RenDiesel is also expected to be as much as two times more fuel efficient than one running on ethanol. RenDiesel contains approximately 60% more energy per gallon than ethanol and diesel engines typically achieve 20-40% more miles per gallon than gasoline engines. RenDiesel also produces fewer volatile organic compound (VOC) emissions than ethanol or traditional diesel.

RenJet, our military and commercial jet fuel, has all of the positive environmental and efficiency benefits of RenDiesel. Moreover, RenJet reduces aircraft particulate matter emissions by 96% in engine idle, a major source of ground level pollution. In addition, the lower density of RenJet fuel could enable aircraft to have a lower take-off weight, which conserves fuel and, therefore, lowers operating costs. Alternatively, the lower density of RenJet fuel could allow aircraft to carry heavier payloads with the same volume of fuel when compared to traditional jet fuel.

We have provided synthetic fuels to:
• United Airlines for use in the first U.S. commercial flight flown on certified alternative jet fuel
• Audi for an extended 1000 mile journey run exclusively on 100% synthetic diesel
• the U.S. Air Force for testing in a T-63 turbine engine
• the U.S. Military for use in a LASSO(R) Utility Vehicle designed and built for the U.S. Military by ICRC/VSE Corporation
• The University of West Virginia for emissions testing of synthetic fuels with a 4,000 horsepower Norfolk Southern locomotive engine, a 1,000 horsepower Caterpillar engine provided by Walker Equipment and a 96 horsepower underground engine provided by the Mine Safety and Health Administration
• commercial airlines for testing

Rentech, through the Rentech F-T Process, can produce renewable specialty chemicals such as naphtha, olefins, paraffins, and waxes.

Rentech can produce renewable power from multiple biomass resources. Renewable RenPowerTM is expected to qualify under the Renewable Portfolio Standard (RPS), Feed-
in-Tariff (FIT) and Renewable Obligation programs and can help regions reduce their dependency on fossil-derived electricity.

**Product Cost**
Specific cost per gallon of fuel produced and megawatt of power will vary based on feedstock and plant design. We expect that our production costs will allow us to be competitively priced with future market prices for diesel and jet fuels as well as renewable power, while earning attractive returns for our investors.

**Offtake partners (if applicable)**
Contract for RenDiesel for ground equipment at LAX: Rentech signed an unprecedented multi-year agreement to supply eight airlines with up to 1.5 million gallons per year of renewable synthetic diesel (RenDiesel®) for ground service equipment operations at Los Angeles International Airport (LAX). The RenDiesel® will be produced at our proposed renewable fuels project in California.

The initial purchasers under the agreement with Aircraft Service International Group (ASIG), the entity that provides fueling services to many airlines that operate at LAX, are Alaska Airlines, American Airlines, Continental Airlines, Delta Air Lines, Southwest Airlines, United Airlines, UPS Airlines and US Airways. Additional airline purchasers of RenDiesel® can be added under the agreement with ASIG. The agreement is the first of its kind to supply renewable synthetic fuels to multiple domestic airlines.

MOU with thirteen airlines for RenJet: Rentech signed a Memorandum of Understanding with thirteen domestic and international passenger and cargo carriers that is intended to serve as a framework for a future definitive supply agreement for certified jet fuel from Rentech’s proposed synthetic fuels and power facility in Adams County, Mississippi (Natchez Project).

The non-binding MOU signed by Rentech and Air Canada, AirTran Airways, American Airlines, Atlas Air, Delta Air Lines, FedEx Express, JetBlue Airways, Lufthansa German Airlines, Mexicana Airlines, Polar Air Cargo, United Airlines, UPS Airlines and US Airways includes terms that are anticipated to serve as the basis of a possible definitive purchase agreement by these carriers for the Natchez Project’s entire synthetic jet fuel production of approximately 250 million gallons per year.

Executed Power Purchase Agreement (PPA) for RenPowerTM: Rentech has a long term PPA in place with Progress Energy Florida for approximately 90% of the electric power produced from our proposed Port St. Joe Project. The project is designed to produce 55MW of power, which is enough to power 50,000 homes.

Agreement with Denbury Resources, Inc. for CO2: Rentech has an agreement with Denbury, an independent oil and gas company, to sell to them all the carbon dioxide we capture at our proposed Gulf Coast Synthetic Energy
Center near Natchez, Mississippi (Natchez Project). Denbury expects to use the CO2 for Enhanced Oil Recovery, which would effectively sequester the carbon. Under this long-term agreement, Denbury plans to build a pipeline to our Natchez facility and transport the captured carbon dioxide underground to depleted oil fields to produce otherwise unrecoverable domestic oil reserves. The CO2 from the Natchez Project will effectively replace naturally occurring CO2 that Denbury is currently extracting from its Jackson Dome deposit.

Past Milestones

In May of 2011, Rentech was selected to receive 1.1 million cubic meters/ year of primarily wood waste and unmerchantable wood fiber to produce renewable certified low-carbon jet fuel from its proposed Olympiad Renewable Energy Center. The proposed wood allocation is the largest ever awarded in the Provincial Wood Supply Competitive Process administered by the Ontario Ministry of Northern Development, Mines and Forestry. The process was highly competitive with over 100 applicants vying for the allocation. The project is being designed to produce 23 million gallons annually of renewable low-carbon jet fuel and 13 million gallons annually of renewable naphtha. Beyond support for the project at the Provincial level, Rentech’s proposed Olympiad Project is supported at the Canadian federal level, with potential project funding of up to C$200 million from SDTC and from the local Aboriginal group, with up to an 18 percent equity investment in the project from Pic River First Nation.

In July of 2009, Rentech acquired SilvaGas Corporation which is a patented gasification technology which produced syngas from a wide variety of biomass feedstocks. The technology has over $100 million in funding from private investors and the US Department of Energy (DOE) and has operated successfully at commercial scale in Burlington, VT. Over the last couple of years the Rentech-SilvaGas technology has been refined and has been incorporated into our proposed Port St. Joe Renewable Energy Center in Port St. Joe, Florida. We have received our final air permit for the project from the Florida Department of Environmental Protection which is one of the final steps necessary to begin construction of the world’s first Biomass Integrated Gasification Combined Cycle (BIGCC) using the Rentech-SilvaGas biomass gasification. We have entered into Term Sheets for the majority of the projects feedstock requirements and finalizing the EPC contract price.

Rentech recently acquired 95% ownership of ClearFuels, bolstering its suite of technologies. By the end of calendar year 2011, the Rentech-ClearFuels Gasifier will be mechanically complete and producing fuels at our PDU facility in Commerce City, CO. The project received $23 million from the DOE to construct the biomass gasifier and integrate it with the Rentech Process. The project will demonstrate a flexible and versatile thermochemical process that coverts mixed biomass feedstocks to a clean controllable syngas for the production of liquid hydrocarbon fuels. The process has the flexibility to convert multiple low-cost cellulosic byproducts and waste products resulting in no land use
changes or added collection or transportation emissions.

**Future Milestones**

Biomass gasification projects: We will be actively working on small scale projects which would allow us to self-fund the commercial deployment of our gasification technologies in projects that could provide a relatively short payback period. We also intend to partner with large companies with existing operational sites with waste streams that can be used as feedstock for our gasifier.

Continued Development of our projects (Olympiad Project and Port St. Joe):

Olympiad Renewable Jet Fuel Project in Canada: We intend to complete Front End Engineering and Design (FEED); secure a source of funding with the Sustainable Development Technology Canada (SDTC); secure an off-take customer for the renewable jet fuel and partner with Pic River First Nations to create job opportunities for the Aboriginal community decimated by the struggling forestry sector. We also intend have a firm off-take agreement with a large commercial airline company.

Port St. Joe Renewable Power Project in Florida: We expect to receive the last remaining permit required for construction; finalize feedstock agreements; finalize the EPC contract price; secure financing; and construct and commission of the facility.

Continued enhancement of our technology portfolio to maintain our energy conversion technology leadership. This includes enhancing, developing and acquiring technologies to allow us to target broader markets, lower our risk, capital cost and improve unit economics. We will look to acquire energy business that have existing operating facilities with cash flows and alternative energy technologies and have existing facilities which we can add our technology to. We will also open the doors of our $100 million plus PDU facility, allowing access to our 70 highly skilled scientist, engineers and technicians and existing infrastructure and technologisto government entities and co-location partners to garner funding for our next generation technology development while advancing renewable energy, fuels and chemical technologies.

**Business Model:**

Rentech’s business model encompasses being:

- a developer/owner/operator of synthetic fuels and power facilities (particularly renewable energy facilities)
- a developer of synthetic fuels and power facilities
- a licensor of energy conversion technologies of biomass gasification and/or Fischer-Tropsch for the production of synthetic fuels and power facilities from renewable and fossil resources as well as a licensor of biomass gasification technology for repowering coal-fired power plants for production of renewable electricity.

Competitive edge:
Rentech has several competitive advantages:

- Integrated biomass-to-fuels technologies ready for commercial deployment. We believe we have a unique combination of integrated technologies, from biomass gasification through syngas cleaning to liquid fuels production that is ready for commercial deployment. This integrated package can produce ultra-clean certified fuels, as well as renewable power, with near-zero carbon lifecycle profiles.
- We maintain technology leadership. We have an unmatched biomass-to-energy technology chain based on proven technologies. We have a strong patent portfolio of demonstrated biomass gasification and Fischer-Tropsch technologies. In addition, our technology allows for economic small-scale commercial production of renewable synthetic fuels as well as large-scale production of synthetic fuels from fossil resources.
- Demonstration stage is behind us. We have successfully funded the construction of development-scale plants and operated those plants, giving us significant operating experience with our technologies. Our demonstration plant gives us the ability to test new technologies at demonstration scale at very low incremental cost. This gives us a significant head start and advantage over companies that have yet to fund or build demonstration scale facilities.
- Operational experience. We constructed and operate the only fully-integrated F-T transportation fuels production facility in the U.S. We have produced thousands of gallons of ultra-clean synthetic fuels including military jet fuel, commercial Jet A and Jet A-1 and ultra-low sulfur diesel have been produced at our facility and have met or exceeded applicable fuels standards. We also have 150 people operating a nitrogen fertilizer plant, and this experience is highly transferrable to the operations of synthetic fuels facilities.
- Drop-in fuels. Our fuel can be used in existing engines and infrastructure and is the only alternate fuel type certified by the U.S. Air Force and FAA. In addition, our fuels can be used as a neat fuel or as a blend.
- Project pipeline. We have a pipeline of projects under development for the production of synthetic fuels and power.
- Strong balance sheet: We have significant cash on our balance sheet and will have an ongoing funding vehicle if our proposed IPO for our fertilizer segment is successful.

Distribution, Research, Marketing or Production Partnerships or Alliances.
We believe that having the right strategic partners will help us realize our vision of delivering clean energy solutions. The many advantages of the Rentech Process have enabled us to enter into relationships with key strategic partners and, as our business grows, we expect to enter into more of these relationships. Developing relationships with world class technology leaders allows us to provide a more complete product offering to our customers, licensees, and partners.

Denbury Resources, Inc. ("Denbury"). Together with gasification and upgrading technologies, the Rentech Process enables us to produce ultra-clean fuels and chemicals that are cleaner than petroleum-based products in terms of regulated emissions (NOX, SOX, and particulates) and carbon dioxide. Our process captures up to approximately 80%
of the carbon dioxide generated during the production process. We have entered into an agreement with Denbury, an independent oil and gas company, to sell to them all the carbon dioxide we capture at our proposed Gulf Coast Synthetic Energy Center near Natchez, Mississippi (Natchez Project).

Denbury expects to use the CO2 for Enhanced Oil Recovery, which would effectively sequester the carbon. Under this long-term agreement, Denbury plans to build a pipeline to our Natchez facility and transport the captured carbon dioxide underground to depleted oil fields to produce otherwise unrecoverable domestic oil reserves. The CO2 from the Natchez Project will effectively replace naturally occurring CO2 that Denbury is currently extracting from its Jackson Dome deposit.

It is estimated that the carbon dioxide generated in the production of one barrel of synthetic fuel like RenDiesel® or RenJet® will facilitate the production of two additional barrels of crude oil. Our relationship with Denbury will lower the carbon footprint of the Natchez Project as well as help America's efforts to reduce its dependency on imported oil. Moreover, we believe the emissions reducing characteristics of the Rentech Process, together with our alliance with Denbury, will result in our Natchez facility being one of the cleanest fuel production facilities in the country.

UOP. UOP, a Honeywell company, whose roots date back to 1914, is the premier refining technology company in the world. UOP’s cutting-edge technology advances create higher yields and higher quality products. In addition, they also create cleaner technologies and processes for a healthy environment. Rentech has entered into an agreement with UOP to jointly offer our two companies' respective technologies for the commercial production of synthetic fuels. The proprietary and patented Rentech Process can convert synthesis gas from a wide array of biomass and fossil resources into ultra-clean hydrocarbons. These hydrocarbons are then converted into finished fuels with UOP hydrocracking and hydrotreating technology. As commercialization partners, Rentech and UOP expect to increase our market reach and jointly offer proven technologies that can produce products that are cleaner than traditional petroleum-derived fuels and chemicals UOP’s technology will be used to refine and upgrade hydrocarbons from the Rentech Process into ultra-clean synthetic renewable RenDiesel and naphtha.

Fluor Corporation (“Fluor”). Fluor is providing the front-end engineering and design (FEED) services for our proposed facility in California. Fluor has executed more than 20 gasification projects globally and performed more than 150 gasification feasibility studies. In addition, Fluor has helped develop the major Fischer-Tropsch plants in operation today.

Jacobs Engineering Group, Inc (“Jacobs”). We launched an engineering program with Jacobs Engineering Group Inc., one of the world’s largest and most diverse providers of engineering and construction services, to assist us in completing a commercial-scale Reactor Design Package for the Rentech Process. This work will enable us to estimate the capital costs for our reactor. Jacobs also conducted the feasibility engineering work for our
proposed facility in California.

Aircraft Service International Group ("ASIG"). We have signed an unprecedented multi-year agreement to supply eight airlines with up to 1.5 million gallons per year of renewable synthetic diesel (RenDiesel®) for ground service equipment operations at Los Angeles International Airport (LAX) beginning in late 2012, when our proposed facility, is scheduled to go into service.

The initial purchasers under the agreement with ASIG, the entity that provides fueling services to many airlines that operate at LAX, are Alaska Airlines, American Airlines, Continental Airlines, Delta Air Lines, Southwest Airlines, United Airlines, UPS Airlines and US Airways. Additional airline purchasers of RenDiesel® can be added under the agreement with ASIG.

US Air Force. The US Air Force has purchased our synthetic jet fuel for performance and emissions testing in a turbine engine. The purchase followed the Air Force’s laboratory testing of Rentech’s synthetic jet fuel, which confirmed that the quality and characteristics of our jet fuel meet the Air Force’s specifications for synthetic fuels.

United Airlines. United Airlines, one of the world’s largest carriers, partnered with Rentech to conduct an engineering validation flight to using Rentech’s certified synthetic jet fuel (RenJet®). The flight marked the first time a U.S. commercial airline used synthetic jet fuel in flight and underscored role synthetic jet fuel such as Rentech’s will play in a lower carbon future with the use of domestic technology and resources to fuel the nation’s transportation needs.

Audi. Audi, the world’s fastest growing car company, partnered with Rentech for a four-day, 1,000 mile journey across California. During the journey, two Audi A3 TDIs, Green Car Journals’ 2010 Green Car of the Year, were fueled exclusively on 100% synthetic RenDiesel. The endurance drive demonstrated that today’s diesel technology and Rentech’s synthetic RenDiesel have significant green advantages in the push to reduce greenhouse gas emissions and fuel consumption to make America less reliant on imported oil.

Norfolk Southern and Walker Caterpillar. Rentech sponsored several tests of synthetic fuels in various engine types. The University of West Virginia conducted emissions testing of synthetic fuels with a 4,000 horsepower Norfolk Southern locomotive engine, a 1,000 horsepower Caterpillar engine provided by Walker Equipment and a 96 horsepower underground engine provided by the Mine Safety and Health Administration. Initial results of these tests have confirmed that synthetic fuels are cleaner burning than traditional ultra-low sulfur diesel fuels, with lower particulate matter and no visible emissions from the use of these synthetic fuels in the engines. Ongoing testing of synthetic fuels in a fleet of on-road vehicles is continuing for further data collection on fuel efficiency and emissions.
Pall Corporation. Pall Corporation, a world leader in filtration and separation technology has entered into a Preferred Supplier Agreement with Rentech to supply leading edge AccuSep® purifying technology to our Rentech Process. The AccuSep® purifying technology will allow us to separate the wax created from the Rentech Process from our catalyst. The technology will be utilized at our Product Demonstration Unit and future projects.

Mann Turbo & Diesel. Mann Turbo & Diesel based in Augsburg, Germany, is one of the world’s leading providers of gas turbine engines and is one of Germany’s 30 largest companies. We have entered into a supply agreement with Mann Turbo & Diesel to supply Rentech’s proprietary Fischer-Tropsch equipment.

Hitachi Zosen Corporation. Hitachi Zosen Corporation, a Japanese developer, manufacturer, and seller of environmental equipment has entered into exclusive supply agreement with Rentech to produce our proprietary Fischer-Tropsch equipment.

ENVIRON International (“ENVIRON”). ENVIRON has been engaged to act as Rentech’s consultant and contractor for the permitting process for our proposed California facility. ENVIRON will assist in preparing applications for permits necessary to construct and operate the project and also perform technical studies for the environmental documents needed to satisfy the California Environmental Quality Act (CEQA). ENVIRON has been involved in the issuance of major air permits in California’s South Coast Air Quality Management District, the agency to which California projects are subject, and has long been involved with preparing environmental documentation under CEQA.

Province of Ontario, Canada:
The province of Ontario, the most populous province in Canada and second largest in total area, awarded Rentech with a proposed 1.3 million U.S. tons per year of crown timber mostly comprised of forest waste and unmerchantable species. The feedstock is expected to be used as feedstock for the proposed Olympiad Renewable Energy Center in the Township of White River, Ontario.

National Renewable Energy Laboratory (NREL). NREL is the United States’ primary laboratory for renewable energy and energy efficiency research and development. NREL is a government-owned, contractor-operated facility; it is funded through the U.S. Department of Energy (DOE).

Saskatchewan Research Council (SRC) SRC is a Canadian leader in the development of gasification and next-generation syngas conditioning technologies.

Stage (Bench, pilot, demonstration, commercial)

1. Our Rentech-SilvaGas biomass gasification technology operated at a commercial
scale of 400 tons per day.

2. Our Product Demonstration Unit is a demonstration scale plant that produces 10 barrels per day of synthetic jet and diesel fuel. It is the only operating integrated synthetic fuels plant operating in the U.S. today. Our Rentech-ClearFuels gasifier will be mechanically complete and demonstrated by the end of the year at our PDU facility.

3. Our Port St. Joe Renewable Energy Center, currently under development, is a commercial scale plant that is expected to generate sufficient economic returns for investors, and will employ both our Rentech-SilvaGas biomass gasification technology to produce 55MW of renewable power.

During our nearly 30-year history, Rentech and our licensees have successfully applied the Rentech Process in facilities ranging in size from pilot scale to 300 barrels per day of synthetic fuels and chemicals production. Our first renewable facility was built in 1992 and used landfill gas to produce alternative fuels. Rentech’s technologies have been chosen for demonstration at DOE sponsored facilities; the Rentech Process at DOE’s Laporte, TX facility and the Rentech-SilvaGas gasification process at the McNeil power station in Burlington, VT.

Website URL
www.rentechinc.com
Rivertop Renewables

Company description:
Based in Missoula, Montana, Rivertop Renewables is innovating a new category of science – Progressive Chemistry. Merging proven science with renewable resources, Rivertop Renewables is creating an abundant and economical supply of sustainable, biodegradable and non-toxic chemicals and bioproducts derived from renewable plant sugars.

Address:
P.O. Box 8165
Missoula, MT 59807-8165

Year founded: 2008

Annual Revenues: Pre-revenue

Major Investors (if a public company, please provide trading symbol and exchange).
Rivertop is unable to disclose its list of investors.

Type of Processing Technology(ies) : (if applicable)
Rivertop’s oxidation chemistry creates an innovative technology platform which requires little capital to deploy, converts sugars into chemicals very cost-efficiently, and is extremely versatile. A wide variety of feedstocks can be oxidized into building block organic acids that can be applied directly in several markets or used as monomers for downstream applications.

Products: (renewable chemicals (base, fine, specialty, or platform), or bio-based materials (plastics, polymers, monomers, resins, lubricants, inks, detergents, surfactants, rubbers, adhesives, hardeners, additives, or other materials)

Rivertop’s oxidation technology can be used to produce a number of high value chemicals with a wide variety of applications. The company’s first products will be salts and other derivatives of glucaric acid, one of the top 12 building block chemicals identified by the US DOE in its 2004 report, Top Value Added Chemicals from Biomass.

Rivertop initially plans to use its glucaric acid as an effective and cost-competitive replacement for phosphates, citrates, EDTA and NTA in the multi-billion-dollar global detergent market.

Other near term market opportunities for glucaric acid include use in corrosion inhibitors to protect infrastructure and additives for concrete and wallboard. Longer term opportunities include various applications using advanced biodegradable polymers.
Feedstocks:
Rivertop’s oxidation technology is feedstock flexible. It can convert a number of sugars into high value organic acids. Corn is the current source of the cheapest, most abundant sugar – glucose, however algae or cellulosics are expected to provide second generation sources in the future.

Product Cost (if applicable - per US pound):

The primary input for the production of the salts and derivatives of glucaric acid is glucose. A 72% glucose solution derived from U.S. corn costs about $0.20/lb. Notably, for every pound of glucose input, Rivertop’s technology produces over a pound of product.

Offtake partners (if applicable)
Not available to publically announce at this time.

Co-products (if applicable) (e.g. feed, fuel)
N/A, Rivertop is a pure play.

Past Milestones
- Patent foundation secured
- Qualified product in detergent market

Future Milestones
- Close first institutional financing round
- Develop initial customer base utilizing contract manufacturing to prove demand & pre-sell commercial capacity
- Complete the team by recruiting the best in engineering, chemistry, & business development.

Business Model: (e.g. owner-operator, technology licensor, fee-based industry supplier, investor)
Rivertop will sell glucaric acid formulations directly to large product manufacturers and marketers, such as those selling detergents. For fragmented markets or those requiring complex formulations, Rivertop will seek development partnerships.

Competitive Edge(s):
- Capital efficient platform technology
- Feedstock flexible technology
- Immediate, multi-billion dollar markets for first chemical – glucaric acid
- Regulatory driver in sponsoring application – Replacing phosphates in detergents
Security & relentless development of Intellectual Property
Experienced leadership (Stoppert - CEO, Donen - VP of Engineering & Process Development)

Distribution, Research, Marketing or Production Partnerships or Alliances.
Not available to publically announce at this time.

Stage (Bench, pilot, demonstration, commercial)
   Lab – Bench, Pilot in 2011, Commercial in 2013.
Roundtable on Sustainable Biofuels (RSB) Services Foundation

Address: 1420 Spring Hill Road, Suite 600

Year Founded: 2011

Annual Revenues: N/A

Company description: Nonprofit organization providing sustainability certification to biofuel entities

3 Major Milestone Goals for 2013-15 To promote the RSB global standard for socially, environmentally and economically sustainable production of biomass and biofuels.

Business Model: (e.g. owner-operator, technology licensor, fee-based industry supplier, investor) Nonprofit organization

Competitive Edge(s): Providing international certification from the world’s most respected authority on biofuel sustainability. RSB certified organizations are recognized for their commitment to the highest standards of sustainability. They differentiate themselves by associating with industry and conservation leaders via the RSB certification.

Research, or Manufacturing Partnerships or Alliances. N/A

Stage (Bench, pilot, demonstration, commercial) N/A

Website URL: www.rsbservices.org

Chief Executive Officer: Peter Ryus

Business development or sales contact: Matt Rudolf

Contact for follow up information: (Name, title, phone, email) Helena Kennedy, Director of Marketing & Communications, 703-533-7725, hkennedy@rsbservices.org
Sapphire Energy, Inc.

Address:

3115 Merryfield Row
San Diego, CA  92121

Year founded

2007

Company description:

San Diego-based Sapphire Energy is pioneering an entirely new industry – Green Crude Production – with the potential to profoundly change America’s energy and petrochemical landscape for the better. Sapphire’s products and processes in this category differ significantly from other forms of biofuel because they are made solely from photosynthetic microorganisms (algae), using sunlight and CO2 as their feedstock; are not dependent on food crops or valuable farmland; do not use potable water; do not result in biodiesel or ethanol; enhance and replace petroleum-based products; and are low carbon. Green Crude can be refined into the three most important liquid fuels used by our society: gasoline, diesel and jet fuel. The fuels meet ASTM standards and are compatible with the existing petroleum infrastructure, from refinement through distribution and the retail supply chain.

Major Investors (if a public company, please provide trading symbol and exchange).

Sapphire Energy is supported by a world-class syndicate of investors led by co-founder ARCH Venture Partners; along with The Wellcome Trust; Cascade Investment, LLC; and Venrock.

Type of Technology(ies)

Green Crude, a renewable biofuel made solely from photosynthetic microorganisms (algae), using sunlight and CO2 as their feedstock. It can be refined directly into drop-in replacements for gasoline, diesel and jet fuel, using the existing petroleum refinery infrastructure.

Feedstocks:

Our algae have been bred to tolerate high PH conditions and salty water, and require only sunlight, C02 and some nutrients as feedstocks.
Products (e.g. ethanol, biobutanol, biodiesel, renewable diesel, renewable jet fuel, power, organic acids, bioplastics etc)

Green Crude, an algae-based renewable oil developed as drop-in replacement for petroleum. It can be refined into gasoline, diesel fuel and aviation fuel in existing refineries for use in existing engines.

**Product Cost** (if applicable - per US gallon): (Costs per US gallon for fuels, costs per pound for chemicals and/or biomaterials. If you do not manufacture or have long-term stable feedstock pricing, please use the latest December futures contract pricing for traded feedstocks, or $55/ton for untraded biomass - or provide notes on your own feedstock pricing assumptions).

When we reach commercial readiness, our plan is to be price competitive with traditional crude. Current industry estimates are for algae-based green crude production to result in a $75 and $85/barrel cost at commercial scale.

**Past Milestones**

- Sapphire Energy partners with The Linde Group, the leading merchant CO2 supplier in the U.S., to reduce the costs associated with the delivery of anthropogenic CO2 for commercial-scale open pond algae cultivation. In addition, Linde will supply all of the CO2 to Sapphire’s commercial demonstration facility in Columbus, New Mexico.

- Sapphire Energy, Inc. and Monsanto Company announced an agreement to enter a multi-year collaboration that will leverage Sapphire’s algae based research platform to discover genes that could be applied to agriculture, particularly in the field of yield and stress.

- In 2010, Sapphire Energy began construction for our Integrated Algal Bio-Refinery in Southern New Mexico, a project that was awarded more than $100 million in federal grant money from the American Reinvestment and Recovery Act through the U.S. Department of Energy and a loan guarantee from the U.S. Department of Agriculture Bio-refinery Assistance Program.

* Completed phase 1 of Green Crude Farm.

**Future Milestones**

- Completion and operation of phase 1 and 2 of the IABR. 2013, construction and operation of all IABR phases united in 2014.

*Public policy, algae tax parity and a more technology neutral RFS.*
- Expanded partnerships.

**Business Model:** (e.g. owner-operator, technology licensor, fee-based industry supplier, investor)

Developer and producer of Green Crude

**Competitive Edge(s):**

Scale to Growing Demand: Sapphire Energy’s algae based green crude can scale to meet our domestic demand for transportation fuels. Today, the debate is not about who can make algae-based fuel, it is about who can scale as the demand grows. This is Sapphire’s strength.

The Only Truly Scalable Option: Sapphire Energy continues to lead the space as the industries’ only pure algae play. All other technology solutions require carbohydrates and sugar in their process, which cannot scale to truly replace petroleum.

Phased Drop-In Replacement: Another of the many beauties of Sapphire’s “green crude” is that it can drop directly in where petroleum currently is used without any changes to the infrastructure in vehicles, aircraft and more.

Value to the Value Chain: Sapphire Energy’s intellectual property position in the space gives the company freedom to operate with over 244 active patent cases with 45% of all patents in algae tied to Sapphire. It spans the full spectrum of algae fuel and products, providing multiple layers of competitive advantage across the entire value chain from platform technologies, traits and organisms, production systems, refining methods and products.

Grants and Government Partnerships: In December 2009, Sapphire was awarded $104.5 million in federal funds to build and operate a first-in-kind commercial demonstration scale algal biorefinery, integrating the entire value chain of algae-based fuel, from cultivation to extraction to refining. This award exemplifies the value the Administration sees in weaning dependency off petroleum as the sole option and transitioning to a purposeful and valid form of new energy. The funds are in addition to significant private investment and will ensure we can accelerate commercialization of algae-based fuels, which will fundamentally change our nation’s energy future, help address climate change, and stimulate green collar job growth.

In Top 10 Clean Tech Companies Most Likely to Succeed: Sapphire Energy was chosen as one of the top 10 venture-backed, clean tech companies of 2011 by the Wall Street Journal during the WSJ ECO:nomics Conference. Unveiling its second annual “Next Big Thing,” the Wall Street Journal chose Sapphire for its experience, capital, and potential for
producing green crude from algae as a method to wean consumption off foreign oil and onto a home-grown proven fuel alternative.

Research, or Manufacturing Partnerships or Alliances.

As part of the American Recovery and Reinvestment Act and through the biorefinery assistance program in the 2008 Farm Bill, Sapphire has partnered with both the USDOE and the USDA to build a next-generation algal biorefinery, funded by $104 million in grants and loan guarantees. Sapphire is also collaborating with leading scientists from the Department of Energy’s Joint Genome Institute; University of California, San Diego; The Scripps Research Institute; University of Tulsa; and San Diego Center for Algal Biotechnology. Sapphire Energy has also established partnerships with Linde Corp, to obtain a low cost, long-term supply of CO2, and Monsanto, for collaboration in algae research to improve yield.

Stage (Bench, pilot, demonstration, commercial)

We are in the commercial demonstration phase, and have a test and demonstration site in Las Cruces, NM. Our technology has been proven, and we are in the process of demonstrating what is needed to scale to commercial volumes. Our Integrated Algal Biorefinery, currently under construction, in Columbus, NM, is scheduled to be operational in 2012 and produce 1 million gallons of biofuel per year by 2013. The purpose of that is to demonstrate how algal oil can be refined into Jet-fuel, diesel and gasoline on a continuous commercial scale.

Website URL

www.sapphireenergy.com
SG Biofuels

Address: 11260 El Camino Real, Suite O, San Diego, CA 92130

Year founded  2007

Annual Revenues: Undisclosed

Company description:

SG Biofuels is a bioenergy crop company using molecular breeding and biotechnology to develop elite, hybrid seeds of Jatropha. The company has sold more than 250,000 acres of its hybrid Jatropha seed, including orders from two of the top 20 largest energy companies in the world.

SGB’s JMax Jatropha Optimization Platform™ draws from the world’s largest and most diverse library of Jatropha genetic material, the sequence of the Jatropha genome, molecular markers and advanced biotech and synthetic biology tools to select, test and scale elite Jatropha cultivars for unique growing conditions around the world.

Major Investors (if a public company, please provide trading symbol and exchange).

- Flint Hills Resources (10th largest oil refiner in the United States; a wholly-owned subsidiary of Koch Industries)
- Life Technologies Corporation (NASDAQ: LIFE)
- Kitano Capital

Type of Technology(ies)

Intensive selection and breeding programs are identifying and developing the most productive, regionally adapted strains from the company’s germplasm collection. Through outcrossoes to combine important traits and inbreeding to improve uniformity, considerable advancements have already been achieved.

SG Biofuels plant biotechnology program is accelerating the improvement of Jatropha through the association of molecular markers with trait genes and the development of plant regeneration, transformation and dihaploid technologies.

The company has formed an alliance with Life Technologies Corporation, a leading provider of advanced biotechnology and synthetic biology tools.

The partnership has successfully sequenced the Jatropha curcas genome, using the SOLiD™ 4.0 System by Life Technologies. Working with Life Technologies, SG Biofuels
has used the sequence to generate a high quality Jatropha reference genome. The genome has been used to compare re-sequences generated from SG Biofuels' germplasm library to identify molecular markers and trait genes to accelerate development of elite cultivars.

**Feedstocks:**

Jatropha: a non-edible shrub that is native to Central America. Its seeds contain high amounts of oil that can be used for a variety of bio-based materials including biodiesel and feedstock substitutes for the petrochemical and jet fuel industries. Because it is non-edible and can be effectively harvested on marginal land that is considered undesirable for food crops, it does not compete with global food supplies.

Successful flights by Air New Zealand, Continental, Boeing, Rolls Royce and others have validated Jatropha as a superior source of jet fuel, in large part due to its superior performance at cold temperatures.

Products (e.g. ethanol, biobutanol, biodiesel, renewable diesel, renewable jet fuel, power, organic acids, bioplastics etc)

Crude Jatropha oil can be used for a variety of bio-based materials including renewable diesel, biodiesel and as a feedstock substitute for the petrochemical and jet fuel industries.

Through its JMax™ hybrid seed product line, and patent-pending hybrid seed production methodology, SG Biofuels provides growers high yielding, uniform and profitable Jatropha seeds that have been adapted to their growing conditions. Hybrid seeds result in greater yield, uniformity and vigor while significantly reducing handling and deployment costs.

**Product Cost** (if applicable - per US gallon): (Costs per US gallon for fuels, costs per pound for chemicals and/or biomaterials. If you do not manufacture or have long-term stable feedstock pricing, please use the latest December futures contract pricing for traded feedstocks, or $55/ton for untraded biomass – or provide notes on your own feedstock pricing assumptions).

SGB’s hybrid Jatropha can produce high quality Jatropha crude oil at a production cost of between $55 and $65 per barrel today, with a clear path to reduce production costs to $30 per barrel through molecular breeding and biotechnology.

**Offtake partners** (if applicable)

Flint Hills Resources, Bharat Renewable Energy (BREL)

Past Milestones
• Signed customers for more than 250,000 acres of hybrid Jatropha seed including 2 of the top 20 largest energy companies in the world, including Bharat Renewable Energy (JV
of Bharat Petroleum, the second largest petroleum company in India).

- Developed industry-leading, patent-pending hybrid seed production methodology, revolutionizing Jatropha through increased yields, uniformity and reduced handling costs for growers.
- Established operations and customer relationships in Brazil and India.

**Future Milestones**

- Pioneer innovations in Jatropha to improve yields and drive production costs to $30 per barrel.
- Exceed 1 million acres in seed sales and establish Jatropha as the next big global row crop.
- Establish strategic partnerships addressing the full value chain and the deployment of profitable institutional-scale plantations.

**Business Model:** (e.g. owner-operator, technology licensor, fee-based industry supplier, investor)

**Competitive Edge(s):**

- JMax hybrid Jatropha seeds resulting in a production cost of crude Jatropha oil of between $55 and $65 per barrel.
- The executive management team includes direct experience at companies including DuPont’s Pioneer Hi-Bred, Syngenta, Monsanto, Diversa, Dow Agro Sciences and Chromatin.
- A fully-integrated platform providing upstream and downstream expertise, led by partnerships and investments from Life Technologies Corporation and Flint Hills Resources and an alliance with Bharat Renewable Energy.
- Hybrid seed production technology, resulting in significantly greater yield, uniformity and vigor while reducing handling and deployment costs for plantation developers.
- Customer orders for more than 250,000 acres of hybrid Jatropha seed, as well as a global pipeline of more than 1.5 million acres.
- Access to the vast biotech and synthetic biology resources of Life Technologies. A completed sequence of the Jatropha genome, accelerating the identification and development of key traits.
- Development of the world’s largest collection of Jatropha genetic material, including 12,000 unique genotypes gathered from the center of origin for the plant in Central America.
- The JMax Jatropha Optimization Platform enabling the adaptation of elite hybrid varieties of Jatropha for growing conditions around the world. Global coverage includes operations in Central America, Brazil and India.

**Research, or Manufacturing Partnerships or Alliances.**

- Bunge (NYSE: BG)
• Flint Hills Resources
• Life Technologies Corp (NASDAQ: LIFE)
• Bharat Renewable Energy Limited (BREL)
• Brookhaven National Laboratory
• Roundtable on Sustainable Biofuels
• Danforth Plant Science Center
• Hawaii Agriculture Research Center

Stage (Bench, pilot, demonstration, commercial)

Commercial

Website URL

www.sgbiofuels.com
Solazyme, Inc.

Address:
225 Gateway Boulevard, South San Francisco, CA 94080

Year founded
2003

Company description:
Solazyme, Inc. is a renewable oil and bioproducts company that transforms a range of low-cost plant-based sugars into high-value oils. Headquartered in South San Francisco, Solazyme’s renewable products can replace or enhance oils derived from the world’s three existing sources – petroleum, plants and animal fats. Initially, Solazyme is focused on commercializing its products into three target markets: (1) fuels and chemicals, (2) nutrition and (3) skin and personal care.

Major Investors (if a public company, please provide trading symbol and exchange).
NASDAQ: SZYM

Type of Technology(ies):
Solazyme has developed a proprietary biotechnology platform that creates tailored oils to address products across the fuels and chemicals, nutritional, and beauty and personal care markets. Solazyme’s innovative capability to “tailor oils” refers to their ability to produce oil with specific desired chain lengths, saturation and functional branching, providing benefits and functionality beyond those typically available with traditional oils.

Feedstocks:
Solazyme’s unique platform is feedstock flexible. The company is able to utilize a wide variety of plant sugars— including sugarcane-based sucrose, corn-based dextrose, and other biomass sources such as cellulosics — to produce their oils.

Products (e.g. ethanol, biobutanol, biodiesel, renewable diesel, renewable jet fuel, power, organic acids, bioplastics etc)
- Solajet™: 100% algal-derived renewable jet fuel
- Solazyme’s 100% algal-derived hydrotreated renewable jet fuel (HRJ-5) meets military specifications
- SoladieselRD®: 100% algal-derived renewable diesel
- Solazyme’s 100% algal-derived hydrotreated renewable diesel (HRF-76) meets military specifications
- Algenist™, a line of advanced anti-aging skincare products formulated with alguronic acid, sold at 850 Sephora locations throughout the US and Europe and all 26 Canadian Sephora stores. Algenist has been sold on Canada’s only nationally televised shopping service, The Shopping Channel, in addition to QVC in the US, one of the largest

50 Hottest Companies in Bioenergy 2012-13 • Selector Book
multimedia retailers in the world. Algenist is also available throughout the United Kingdom in all 60 retail locations of the innovative beauty retailer, Space NK.

- Through Solazyme Roquette Nutritionals, our wide platform offers an entirely new category of natural, sustainable, and multifunctional ingredients based on microalgae that help consumers live healthier lives. Our portfolio includes a variety of whole food ingredients that deliver better tasting foods with a vastly superior health profile compared to ingredients in the market today.

**Product Cost** (if applicable - per US gallon): (Costs per US gallon for fuels, costs per pound for chemicals and/or biomaterials. If you do not manufacture or have long-term stable feedstock pricing, please use the latest December futures contract pricing for traded feedstocks, or $55/ton for untraded biomass – or provide notes on your own feedstock pricing assumptions).

  - Solazyme's lead microalgae strains producing oil for the fuels and chemicals markets have achieved key performance metrics that they believe would allow them to manufacture oils today at a cost below $1,000 per metric ton ($3.44 per gallon or $0.91 per liter) if produced in a built-for-purpose commercial plant.

**Offtake partners** (if applicable)
Solazyme has entered into non-binding offtake agreements with Dow Chemical and Qantas. Dow Chemical will purchase up to 20 million gallons (76 million liters) of Solazyme’s oils in 2013, rising to up to 60 million gallons (227 million liters) by 2015. Qantas will purchase a minimum of 200 to 400 million liters of Solazyme’s jet fuel per year.

**Past Milestones**

  - Produced over 283,000 liters of military-spec diesel (HRF-76) for U.S. Navy contract. Further solidifying its relationship with the U.S. Navy, Solazyme has completed production of over 283,000 liters of in-spec marine diesel fuel, HRF-76, for the U.S. Navy, in fulfillment of the first phase of its Defense Logistic Agency (DLA) contract that calls for production of up to 550,000 liters in two phases. The initial fuel production for phase 1 of this contract was completed ahead of schedule and is currently expected to be delivered ahead of the contract delivery date. Additionally, the U.S. Navy has indicated its intent to exercise its phase 2 option and has transferred funding to the DLA, which is set aside exclusively for the phase 2 modification, which is currently being negotiated. The phase 2 fuel would be produced through the first half of 2012. Furthermore, Solazyme’s algal-derived marine diesel has been successfully tested in a United States Navy Riverine Command Boat, and Solazyme’s jet fuel has been successfully tested in a MS 60S Seahawk helicopter demonstration.

  - Signed framework agreement with Bunge Limited for commercial renewable oil plant in Brazil. Both companies have entered into a framework agreement for the formation of a
joint venture focused on the production of triglyceride oils in Brazil. The JV will focus on the production of triglyceride oils from sugar cane, and will result in the construction of the first commercial facility dedicated to tailored oils. The plant, which will enable the production of 30 million gallons of triglyceride oils per year, will break ground in 2012 and begin operations in 2013. The facility will be located adjacent to a Bunge owned sugar cane mill in Brazil, and will leverage both Solazyme’s breakthrough sugar-to-oil technology and Bunge’s sugarcane milling and natural oil processing capabilities.

- Partnered with Dow Chemical for development of Solazyme’s micro algae-derived oils for use in bio-based dialectic insulating fluids. Solazyme and Dow Chemical announced a non-binding agreement for the execution of both a joint development agreement and a letter of intent to advance the development of Solazyme’s algal oils for use in bio-based dialectic insulating fluids. Under the LOI, Dow Chemical will purchase up to 20 million gallons (76 million liters) of Solazyme’s oils in 2013, with the figure rising to up to 60 million gallons (227 million liters) by 2015.

- Purchase of Peoria, IL facility and commencement of the build-out of Peoria facility including DOE approval of relocation of IBR. Solazyme will shift the location of its integrated biorefinery to its Peoria facility. Solazyme began the build-out of this recently acquired facility, adding fermentation capacity and performing upgrades after completion of the acquisition in May 2011. The fermentation portion of this facility is expected to be operational in the second half of 2011, with end-to-end manufacturing expected in the first half of 2012. Acquiring additional capacity and shifting from toll manufacturing to in-house production represents an important milestone.

**Future Milestones**
- In 2012, Solazyme expects to break ground on their first Fuels and Chemicals facility; the facility is slated to come online in 2013
- In 2012, Solazyme plans to increase their owned capacity to approximately 8,000 metric tons through the expansion of a Peoria facility as well as the completion of their Phase I and II Solazyme Roquette Nutritionals facilities
- By the end of 2014, Solazyme expects to be approaching its goal of having 550,000 metric tons of production capacity by 2015, which would support over $1 billion in product revenue

**Business Model:** (e.g. owner-operator, technology licensor, fee-based industry supplier, investor)
- Partnership model – Solazyme looks for strategic partners in major markets to drive forward development and commercialization. In addition to funding development work and performing application testing, Solazyme’s expects that their partners will enter into long-term purchase agreements (offtakes) with them. They are currently engaged in development activities with multiple partners, including Chevron, Dow, Ecopetrol, Qantas and Unilever, any of which could represent attractive future offtake opportunities. They expect future partnerships to provide access to distribution, merchandising, sales and
marketing, customer relationship management and product development knowledge and resources. In conjunction with these development activities, Solazyme has entered into non-binding letters of intent with Dow and Qantas for the purchase of our products (offtakes). Subject to certain conditions, including entry into a supply agreement, Dow will purchase up to 20 million gallons (76 million liters) of our oils in 2013 rising to up to 60 million gallons (227 million liters) by 2015 and Qantas will purchase a minimum of 200 to 400 million liters of our jet fuel per year.

- Market entry- Solazyme has developed a sequential market entry strategy as their technology is capable of producing oils for multiple markets. Solazyme’s business strategy has been to enter into high value market as they ramp up production capacity. The flexibility of their technology platform, coupled with the myriad uses of oil gives them a $1.5 trillion dollar addressable market. Initially, they are focused on three large markets: Skin and Personal Care, Nutritionals, and Fuels and Chemicals. They have targeted commercialization in the higher margin Skin Care and Nutritionals segments, while aggressively ramping their planned manufacturing in Fuels and Chemicals.

**Competitive Edge(s):**

Feedstock and target market flexibility. Solazyme's technology platform provides them with the flexibility to choose from among multiple feedstocks on the input side and multiple specific products (and markets) on the output side, while using the same standard industrial fermentation equipment. A manufacturing facility utilizing a given plant-based sugar feedstock can produce oils with many different oil compositions. Conversely, Solazyme can produce the same oil compositions by processing a wide variety of plant-based sugar feedstock. This flexibility enables Solazyme to choose the optimal feedstocks for any particular geography, while also enabling us to produce a wide variety of oils from the same manufacturing facility.

Low production cost enables broad market access. The production cost profile Solazyme has already achieved provides attractive margins when utilizing partner and contract manufacturing for the nutrition, and skin and personal care markets in which they are currently selling their products. Based on the technology milestones Solazyme's have demonstrated, they believe that they can profitably enter the fuels and chemicals markets when they commence production in larger-scale, built-for-purpose commercial manufacturing facilities utilizing sugarcane feedstock.

Tailored oils. Solazyme has created a paradigm that enables the company to design and produce novel tailored oils that cannot be achieved through blending of existing oils alone. These tailored oils offer enhanced value as compared to conventional oils. Their oils are drop-in replacements such that they are compatible with existing production, refining, finishing and distribution infrastructure in all of their target markets. Technology proven at scale. Solazyme believes that they have produced more non-ethanol, microbial-based fuels and oils than any other company in the advanced biofuels industry.
From January 2010 through February 2011, Solazyme produced well over 500,000 liters (455 metric tons) of oil. To satisfy the testing and certification requirements of the US Navy, Solazyme partnered with Honeywell UOP to refine a portion of this oil into over 200,000 liters (182 metric tons) of military specification marine diesel and jet fuel.

Further solidifying its relationship with the U.S. Navy, Solazyme has completed production of over 283,000 liters of in-spec marine diesel fuel, HRF-76, for the U.S. Navy, in fulfillment of the first phase of its Defense Logistic Agency (DLA) contract that calls for production of up to 550,000 liters in two phases. The initial fuel production for phase 1 of this contract was completed ahead of schedule and is currently expected to be delivered ahead of the contract delivery date. Additionally, the U.S. Navy has indicated its intent to exercise its phase 2 option and has transferred funding to the DLA, which is set aside exclusively for the phase 2 modification, which is currently being negotiated. The phase 2 fuel would be produced through the first half of 2012.

Commercial products today. In 2010, we launched our first product, the Golden Chlorella® line of dietary supplements, as a market development initiative, with products incorporating Golden Chlorella® currently being sold at retailers including Whole Foods and GNC. In March 2011, we launched our Algenist™ brand for the luxury skin care market through marketing and distribution arrangements with Sephora International, Sephora USA and QVC. Distribution of our Algenist™ line of skin care products is expected to reach more than 850 retail stores worldwide by year end, including all 26 Canadian Sephora stores. Algenist has been sold on Canada's only nationally televised shopping service, The Shopping Channel, in addition to QVC in the US, one of the largest multimedia retailers in the world. Algenist is also available throughout the United Kingdom in all 60 retail locations of the innovative beauty retailer, Space NK.

**Research, or Manufacturing Partnerships or Alliances.**

Solazyme is working with a range of companies and government organizations, including Chevron, the Department of Energy, Department of Defense, Dow Chemical, Bunge, Ecopetrol, Roquette, Sephora, Qantas, Unilever, and the U.S. Navy.

Notably, Solazyme has launched a JV agreement with Roquette (SRN), signed JDA extensions with Chevron, Unilever and Bunge, and entered into offtake agreements with Dow Chemical and Qantas. Solazyme also recently announced a JV agreement with Bunge focused on production of triglyceride oils in Brazil. Additionally, the U.S. Department of Defense (DoD) selected Solazyme to research, develop and demonstrate commercial scale production of algae-derived biofuel, meeting the U.S. Navy's specifications for military tactical platforms. To date, Solazyme has delivered the largest quantities of non-ethanol, microbial-based fuels and oils in history to the US Navy.

As a result of their R&D, Solazyme has become the only company that has produced and delivered large quantities of microbial derived non-ethanol advanced biofuels that meet industry specifications as well as tough military fuel specifications.
Stage (Bench, pilot, demonstration, commercial): Commercial

Website URL www.solazyme.com
Solix

Based in: Colorado

Business: Algal fuel developer

Model: Owner-operator

Past milestones: Solix Biofuels completed its $16.8 million Series A capital funding that added Shanghai Alliance Investment to its group. Proceeds will be used to finance construction and commencement of operations at the company's Coyote Gulch Demonstration Facility, which will be operational by late summer 2009. I2BF Venture Capital, Bohemian Investments, Southern Ute Alternative Energy LLC, Valero Energy Corp., and Infield Capital also invested in this round.

Solix Biofuels said that it has commenced production of algal oil at its Coyote Gulch Demonstration Facility, and said that full-scale commercial operation would commence later this summer. The Coyote Gulch farm is on two acres near Durango, on Southern Ute tribal land. Solix said that it expects to reach a production rate of 3,000 gallons per acre per year by later this year at the facility.

Dr. Bryan Willson, co-founder and Chief Technology Officer of Solix, has been named to the Scientific American 10: Guiding Science for Humanity", as "the 10 most influential people in the nation who have demonstrated outstanding commitment to assuring that the benefits of new technologies and knowledge will better humanity."

In September, BASF and Solix Biofuels announced an agreement to investigate the use of algae to produce certain chemicals for BASF. Solix is a leading developer of algae cultivation technology systems and will test multiple algae species in its proprietary growth system, AGSTM, for BASF. “Algae represent a fascinating addition to BASF’s technology portfolio,” said Harald Lauke, President of the Specialty Chemicals Research at BASF, “as they offer the potential to produce a number of exciting specialty products. After surveying the algae industry, we chose to work with Solix based on its knowledge of algal biology and the strength of its AGS.”

Future milestones: Development of commercial-scale photobioreactor facility.

Metrics: The company says it is currently at around 2500 gallons per acre, and said that the company is on track to achieve cost parity with $80 oil in 3-4 years.

The company has said that it can produce algae-based fuel on a scaled-up basis at this point, for $32.81 per gallon. Solix, which has a photobioreactor-based technology, said that it can reduce the cost to $5.50 per gallon by eliminating external power consumed in drying its algae and powering the bioreactors, and reducing it further to $3.50 per gallon through sales of algae-based byproducts including proteins.
Syngenta

**Address:** 11055 Wayzata Blvd., Minnetonka, MN 55305

**Year founded** 2000

**Annual Revenues:** $11.6 billion

**Company description:** One of the world’s leading companies with more than 26,000 employees in over 90 countries dedicated to bringing plant potential to life.

**Major Investors** (if a public company, please provide trading symbol and exchange). New York Stock Exchange (SYT)

**Type of Technology(ies)** Biotechnology

**Feedstocks:** Corn

Products (e.g. ethanol, biobutanol, biodiesel, renewable diesel, renewable jet fuel, power, organic acids, bioplastics etc) Biotech seeds

**Product Cost** (if applicable - per US gallon): (Costs per US gallon for fuels, costs per pound for chemicals and/or biomaterials. If you do not manufacture or have long-term stable feedstock pricing, please use the latest December futures contract pricing for traded feedstocks, or $55/ton for untraded biomass – or provide notes on your own feedstock pricing assumptions).

Dry-grind ethanol plants using Enogen corn can realize an additional value of 8 to 10 cents per gallon due to energy savings and increased throughput.

**Offtake partners** (if applicable)

**Past Milestones**
- USDA deregulation (February 2011)
- Establishing trial for proof of performance (Western Plains Energy, 2009-2010)
- Commercial production of Enogen corn hybrids with yields equal to or greater than hybrids without the technology

**Future Milestones**
- First commercialization in ethanol plants
- Proof of contracted production system with ethanol plants
- Expanded quantification of value added
**Business Model:** (e.g. owner-operator, technology licensor, fee-based industry supplier, investor)
Combination owner-operator and technology licensor

**Competitive Edge(s):** New to the world product – a commonly used enzyme delivered in a revolutionary way that creates added value for ethanol plants and corn producers alike.

**Research, or Manufacturing Partnerships or Alliances.**

Stage (Bench, pilot, demonstration, commercial) Commercial

**Website URL** www.enogen.net

**Contact info:** Jack Bernens

**Chief Executive Officer:** Mike Mack
SynGest Inc.

Company description: Production of specialty chemicals using proprietary biomass gasification to produce anhydrous ammonia/urea (nitrogen fertilizer), methanol, dimethyl ether, polypropylene.

Address: 310 Green Street, San Francisco, CA 94133

Year founded 2008

Annual Revenues: Not provided

Major Investors (if a public company, please provide trading symbol and exchange). Founder financed.

Type of Processing Technology(ies): (if applicable) Oxyblown 2-stage biomass gasification that solves the so-called “gas cleanup” problem. Primary gasifier with 95% oxygen environment followed by oxygen enhanced catalytic auto-thermal reformer. Stage 1 produces primarily syngas (CO and H2) while Stage 2 reforms all tars, BTX and most methane into additional syngas. The 2-stage approach achieves the highest possible biomass to syngas conversion yields while allowing for waste heat recovery sufficient to co-generate enough electric power to allow the plants to be completely off-grid.

Products: (renewable chemicals (base, fine, specialty, or platform), or bio-based materials (plastics, polymers, monomers, resins, lubricants, inks, detergents, surfactants, rubbers, adhesives, hardeners, additives, or other materials) A range of products although primary focus has been on the production of anhydrous ammonia and/or urea to be used as nitrogen fertilizer. Engineering has been completed for projects that would produce methanol, DME and propylene.


Product Cost (if applicable - per US pound): (If you do not manufacture or have long-term stable feedstock pricing, please use the latest December futures contract pricing for traded feedstocks, or $55/ton for untraded biomass – or provide notes on your own feedstock pricing assumptions). At available feedstock prices of $25/T cash flow break-even production of anhydrous ammonia at $300/T.

Offtake partners (if applicable). Unannounced major Midwest agribusiness.

Co-products (if applicable) (e.g. feed, fuel) Biochar.

Past Milestones
   Signed contracts with the entire execution team including (a) Weitz Industrial
Services as EPC, (b) Ambitech Engineering, (c) Alion Science and Technology for gasifier optimization [major: guaranteeing the performance of the gasifier unit operations] and (d) Unitel Technologies for process design.

Completed contract with the State of Iowa Power Fund for a grant of $2.5 million to support the pre-construction engineering of the forts commercial scale facility to be built in Iowa.

Establishment of matching long term feedstock and offtake agreements that meet project finance requirements.

Future Milestones

- Complete FEED
- Financial close for first commercial scale project
- Begin commercial production

**Business Model:** (e.g. owner-operator, technology licensor, fee-based industry supplier, investor)

Technology licensing, project development, facility management, minority owner.

**Competitive Edge(s):** Patent-pending 2-stage biomass gasifier technology, fertilizer industry expertise, deep project development and execution skills.

Distribution, Research, Marketing or Production Partnerships or Alliances.

Stage (Bench, pilot, demonstration, commercial). FEED/Pre-construction engineering leading up to construction of first commercial scale facility.

Projected production volume for 2011: N/A

**Website URL:** www.SynGest.com
Synthetic Genomics

Based in:
California

Business:
Synthetic biology and algal fuel developer.

Model:
R&D partner

Past milestones:

ExxonMobil, the last of the oil majors to commit to a major investment in biofuels, announced that its Research and Engineering unit will invest $300 million into in-house algae research, and up to an additional $300 million in La Jolla-based Synthetic Genomics, the genetics firm founded by J. Craig Venter that has been working on algae-to-energy research since 2005.

SGI has developed techniques for harvesting algal oils, and will focus research on increasing lipid content by manipulating algal strains. The ExxonMobil investment in SGI is contingent on the meeting of R&D goals, according to a report in the New York Times.

"This agreement between SGI and EMRE represents a comprehensive, long-term research and development exploration," said Venter. "We are confident that the combination of our respective expertise in science, research, engineering and scale-up should unlock the power of algae as biological energy producers in methods and scale not previously explored."

"After considerable study, we have determined that the potential advantages and benefits of biofuel from algae could be significant," said Emil Jacobs, EMRE's VP of R&D.

The venture is presented as a research collaboration rather than a commercialization effort at its stage, and could be classified to some extent opposite a $500 million investment made in 2007 by BP in the Energy Bioscience Institute. Chevron has also previously partnered with Solazyme and the National Renewable Energy Laboratory on research efforts in the algae-to-energy field. But for sheer magnitude of investment, the focus on a single bioenergy feedstock, and the focus on a single R&D partner in Synthetic Genomics, the announcement is without parallel in biofuels history.

It may not be possible to interpret this investment as, in itself, a new and imminent path towards algal fuel commercialization, but it can be regarded as confirmation that
ExxonMobil, after a famously long delay, has entered the renewable energy arena, and is placing its bet on algae.

What does this bode for other high-profile algae-to-energy companies?

"We think it's good for algae, and good for us," said Tim Zenk, VP of Corporate Affairs for Sapphire Energy. "The research collaboration announced today sends a loud and clear message that drop-in-replacement liquid transportation fuel produced from algae, above all other biologic choices, is the most viable option to replace crude oil. Algae fuels have significant environmental benefits over crude oil with lower carbon emissions, and are scalable to help nations transition to a secure energy future."

Algae 2020 author Will Thurmond was similarly bullish. "Exxon-Mobil's $600 million dollar commitment to algae based bio-crude and biofuels," Thurmond said, "represents another affirmative commitment by major petroleum companies, research laboratories, private investors and governments that are looking beyond the research and development phase, and are now entering the next stage to scale up and build out industrial-scale systems based on innovative, emerging and disruptive technologies."

In July, Exxon Mobil and Synthetic Genomics announced the opening of a greenhouse facility today enabling the next level of research and testing in their algae biofuels program. In the greenhouse facility, researchers from ExxonMobil and SGI will examine different growth systems for algae, such as open ponds and closed photobioreactors. They will evaluate various algae, including both natural and engineered strains, in these different growth systems under a wide range of conditions, including varying temperatures, light levels and nutrient concentrations. They will also conduct research into other aspects of the algae fuel production process, including harvesting and bio-oil recovery operations.

Future milestones:

In California, a report on Craig Venter in Discover focuses on the Synthetic Genomics founder's ambitions to develop synthetic life forms. While researchers have succeeded in "stitching together pieces of synthesized DNA" and transplanting that to a host bacterium; but the bacterium has been rejecting the genome as an invader, until recent efforts to add methyl tags to M. mycoides allowed the genome to go unnoticed by the bacterial defense system.

The prize? Energy microbes that become monocellular biorefineries, consuming waste energy and converting it to biofuels. It is unclear whether the Synthetic Genomics research effort with ExxonMobil in algae will directly benefit from the R&D effort, as algae is a much more highly complex organism than bacteria. But Venter told the Times, "Assuming we don’t make any errors, I think it should work and we should have the first synthetic species by the end of the year."

Metrics:
$300 million commitment to SGI is reportedly on a milestone-based, stage-gate basis.
ThermoChem Recovery International (TRI)

Based in: 3700 Koppers Street, Suite 405, Baltimore, MD, 21227

Year founded: 1996

Technology:
Steam reforming gasification

Fuel type:

TRI’s high-quality, medium-BTU syngas can be converted into a wide range of downstream biofuel and biochemical products. Since 2003, a TRI gasifier has been in commercial-scale operation at Norampac’s Trenton (Ontario) containerboard mill, gasifying black liquor (solid biomass equivalent: 500 dry tons per day). Currently, TRI is the gasification technology provider for two separate DOE-funded biorefinery projects which will convert TRI syngas to Fischer-Tropsch waxes and diesel for market sale, and provide tailgas to offset natural gas use in the lime kiln. One of these projects, NewPage Corporation, converts 500 dry tons per day of woody biomass feedstock, and the other, Flambeau River BioFuels, converts 1,000 dry tons per day. Both are integrated with existing paper mills and benefit from tight thermal integration of the biorefinery and host facility, utilizing tail gas, steam and hot water streams for maximum economic advantage.

Major investors: The Abell Foundation, Inc., a leading Maryland foundation established in 1953, which makes investments in breakthrough clean energy technology companies based in Maryland.

Past milestones:

- Award of NewPage Corporation’s DOE Biorefinery grant, with TRI as main technology provider
- Award of Flambeau River BioFuels DOE Biorefinery grant, with TRI as main technology provider
- Successful launch of state-of-the-art proprietary 4 dry ton per day Process Demonstration Unit (PDU) in Durham, North Carolina

Future milestones:

- Ground-breaking on NewPage project
- Ground-breaking on Flambeau River BioFuels project
• Project close on RDF-to-fuels project

**Business model:** TRI licenses its proprietary gasification technology and provides specialized equipment and engineering services to integrate biorefineries with energy hosts like pulp and paper mills.

**Fuel cost:**

This varies by feedstock, size and configuration of plant, ability to fully utilize and monetize energy by-products (tail gas, steam, hot water, etc.) and type of end products, but TRI has very competitive operational costs across a range of different project/product scenarios.

**Competitive edge:**

TRI’s main competitive advantages come from three key attributes of its proprietary technology: 1.) an ability to successfully gasify a wide range of feedstocks (woody biomass, agricultural residues, Refuse Derived Fuel, lignite, subbituminous coal, etc.) into a consistent and reliable medium-calorific (300-350 BTU/dscf) syngas; 2.) a proven ability to “dial in” the ideal hydrogen to carbon monoxide (H\(_2\):CO) ratio required by the specific downstream GTL conversion process; and 3.) a highly-scalable steam reformer vessel design such that project sizes from 500 – 2,000 dry tons per day can be accommodated by a single gasification system. TRI can handle a wide range of different feedstocks coming in, and can reliably supply syngas capable of producing a wide range of different energy products.

**Alliances and Partnerships:**

TRI has established research, marketing and technology partnerships across a wide range of entities and resources to most widely commercialize our proprietary technologies. We treat these relationships as business confidential until specific project-related announcements can be made.

**Development stage:**

TRI has been commercial on black liquor, a liquid biomass, since 2003 and is currently at demo scale on solid biomass, entering into commercial scale.

**Website:**

[www.tri-inc.net](http://www.tri-inc.net)
TMO Renewables

Based in: UK

Business: Licensor of a cellulosic microbe that produces up to 15 percent more ethanol than traditional fermentation technology, and reduces energy inputs in the fermentation and distillation process.

Model: Licensing, including a royalty on production of additional gallons of ethanol ("the TMO gallons").

Investors include: Jupiter Asset Management, Noble Group, RAB Capital, Presnow Limited, Diverso Management, Libra Advisors

Past milestones:

1. Development of a secure, scalable application of technology, following the scientific breakthrough of discovering the microbe.

2. Commissioning of the company's demonstration plant in Surrey, UK, used for customer demonstrations and feedstock testing.

3. Raising $18 million in 2009's nefarious capital markets, funds that will be used to take TMO's technology to the US.

Future milestones:

1. TMO is now in the commercialization phase, with "customer, customer, customer" as the focus. Numerous collaborations with ethanol project owners and developers will need to be converted into commercial customer relationships. Look for TMO to secure its first customer this year.

2. Look also for an independent report this year confirming that with use of TMO Renewables technology, starch gallons can qualify as advanced biofuels under the terms of the Renewable Fuel Standard based on direct GHG emissions.

3. Look for increased feedstock flexibility.

Metrics:

TMO's system costs $47-$60 million to implement, although payback comes within three years according to former CEO Hamish Curran. The investment will provide up to 15 Mgy in additional fuel production at a traditional 100 Mgy ethanol plant.
Verdezyne

Verdezyne is a privately held company developing and commercializing novel genetically engineered microorganisms for use as “factories” to manufacture chemicals and fuels, using renewable feedstocks. Verdezyne’s unique microorganisms permit greener, cleaner and more cost effective production of chemicals and fuels as compared with traditional methods. The Company is commercializing its technology through partnerships with leading chemical and fuel manufacturers.

Address:
2715 Loker Ave. West
Carlsbad, CA 92010

Year founded: 2005

Annual Revenues: n/a

Major Investors (if a public company, please provide trading symbol and exchange).
OVP Venture Partners
Monitor Ventures

Type of Processing Technology(ies) : (if applicable)
Verdezyne is a product-focused company that is leveraging its technology platform to optimize the metabolic pathways, microorganisms and fermentation processes that enable economical production of renewable fuels and chemicals

Products:
Biobased adipic acid (a platform chemical)
Bioethanol

Feedstocks:
C6 sugars, C5 sugars (biomass, cellulosic sugars), plant-based oils, by-products from plant-based oil processing, paraffins

Product Cost (if applicable - per US pound): (If you do not manufacture or have long-term stable feedstock pricing, please use the latest December futures contract pricing for traded feedstocks, or $55/ton for untraded biomass – or provide notes on your own feedstock pricing assumptions).

Offtake partners (if applicable)

Co-products (if applicable) (e.g. feed, fuel)
Feed
Past Milestones
- Production of adipic acid biologically
- Partnership agreement with Lallemand Ethanol Technologies to develop and commercialize a genetically enhanced high-yield ethanol producing yeast
- Production of adipic acid from plant-based oil (mixed fatty acids)

Future Milestones
- Commercialize and sell (through our partnership with Lallemand) enhanced yeast, with increased yield and productivity for current ethanol producers
- Announce commercial cellulosic ethanol partner
- Announce commercial adipic acid partner

Business Model: (e.g. owner-operator, technology licensor, fee-based industry supplier, investor)
Technology licensor

Competitive Edge(s):
Verdezyne is a product-focused company that is leveraging its technology platform to optimize the metabolic pathways, microorganisms and fermentation processes that enable economical production of renewable fuels and chemicals.

Verdezyne aggressively pursues intellectual property protection for all aspects of its technology platform and product portfolio. Verdezyne's yeast platform, including the proprietary metabolic engineering methodology “Combinatorial Pathway Engineering” and trade secret algorithms for protein optimization, allows rapid and efficacious strain development with pathways for ethanol, lignocellulosic ethanol and adipic acid.

Distribution, Research, Marketing or Production Partnerships or Alliances.
Lallemand Ethanol Technologies

Stage (Bench, pilot, demonstration, commercial)
- 1st Generation Ethanol: pilot-scale
- Cellulosic Ethanol: lab-scale
- Biobased Adipic Acid: labscale

Projected production volume for 2011:

Website URL
www.verdezyne.com
Verenium

Based in: Massachusetts

Year founded: 2007 (merger of Celunol and Diversa)

Annual Revenues:

- FY 2007 – $46,273
- FY 2008 – $69,659
- FY 2009 – Verenium will not be providing 2009 guidance at this time.

Technology type:
Fermentation, biochemical pathways

Fuel type:
Cellulosic Ethanol, a renewable fuel source produced from natural, non-food feedstocks, such as sugarcane bagasse, dedicated energy crops and wood products. Cellulose, a long-chain polysaccharide found in nearly all plant life, is the most abundant organic compound on earth. The Environmental Protection Agency says cellulosic ethanol’s high-oxygen content reduces carbon monoxide better than other oxygenates.

Major Investors:
AWM Investment Company Inc.
Syngenta AG
HealthCare Ventures LLC

Past milestones:
Verenium begins commissioning nation’s first-of-its kind cellulosic ethanol demonstration plant in Jennings, Louisiana;
Verenium announces plans to build first commercial cellulosic ethanol plant in Highlands County, Florida, with a target capacity of up to 36 million gallons per year (MGY);
British Petroleum (BP) and Verenium form 50-50 joint venture (JV) to develop and commercialize cellulosic ethanol from nonfood feedstocks in the United States; JV now operates under the name Vercipia Biofuels

Future milestones:
Secure financing for first commercial-scale cellulosic ethanol facility in Highlands County, Florida;
Leverage R&D capabilities and enhance cellulosic ethanol capabilities;
Pursue strategic partnership opportunities for the Specialty Enzyme Business Unit
Business model:

The key elements of our corporate strategy are to develop integrated solutions for the emerging cellulosic ethanol industry for use in production facilities that we own and operate, individually or jointly with partners, as well as those of third-party licensees. We intend to use our leadership position to develop novel, high-performance enzymes and to advance our technology and process development capabilities, together with BP, at our pilot and demonstration-scale plants in Jennings, Louisiana, and our first planned commercial facility in Highlands County, Florida, to exploit opportunities in the developing market for the production of cellulosic ethanol. We have established our business model based upon the belief that owning and managing cellulosic ethanol production facilities in conjunction with strategic partners, including BP, will allow us to create economic value by incorporating our scientific and engineering skills into the production facilities. Through our joint venture with BP, we may also license our proprietary technology to extend our commercial reach and accelerate our market penetration.

Establish a sustainable, high-growth, profitable specialty enzymes business.
Our specialty enzyme products and product candidates target high-value applications where we believe our enzyme discovery and optimization technologies can deliver superior, proprietary solutions. We believe our combination of independent and partnered products is positioned to generate substantial product revenues at attractive gross profit margins. In 2008, we generated approximately $49 million in such revenues, an increase of nearly 90% over 2007. We hope to achieve increased product sales and profit margins to support the future growth and profitability of our portfolio of products sold directly by us and by our partners.

Fuel cost:

Our goal from a cost standpoint is to be producing ethanol that is competitive with today’s grain ethanol (~$2/gal).

Competitive edge:

Verenium is the first publicly traded, fully-integrated, next-generation biofuel company, and its range of expertise and resources greatly enhances its potential for success. Verenium is mastering the entire cellulosic ethanol production process as the first and only company with the full range of “field-to-pump” capabilities. This includes: growing energy crops, developing enzymes, processing biomass into fuel and, ultimately, selling it. Additionally, Verenium’s partnerships, which range from industry giants like BP and Syngenta to the U.S. Department of Energy (DOE), make the
company uniquely positioned for success. We have a substantial intellectual property estate, including more than 250 issued patents and more than 350 patent applications, as of March 12, 2009. We believe that we can leverage our intellectual property estate to enhance and improve our technology development and commercialization efforts across both the biofuels and specialty enzymes business units, while maintaining protection of our key intellectual property assets. Verenium’s technology enables conversion of nearly all of the sugars found in cellulosic biomass, including both five-carbon sugars and six-carbon sugars, into ethanol. This efficiency advantage, combined with low-input cost of cellulosic biomass, results in superior economics in the production of ethanol.

Distribution, research, marketing or production partnerships or alliances:

Alfa Laval (enzyme collaboration), BASF (enzyme collaboration), BP (commercialization of cellulosic ethanol), Bunge (enzyme discovery and development), Cargill (enzyme discovery and development), Danisco (enzyme discovery and development), DOE (cellulosic ethanol fermentation technology, enzyme development for breaking down biomass), Fermic (manufacturing of enzymes), Lykes Bros. (agribusiness), Marubeni Corporation (licensee), Scion (enzyme collaboration), Syngenta (enzyme cocktail collaboration), Tsukishima Kikai Co. Ltd. (construction of Osaka plant), University of Florida (fermentation organisms).

Development stage:

Website URL:
www.verenium.com
Virdia

Address: 901 Hillsboro St. Oxford, NC 27565

Year founded 2007

Annual Revenues: N/A
Company description: HCL CleanTech Inc is commercializing technologies developed at its fully owned subsidiary HCL CleanTech Ltd (Israel)

Major Investors: Khosla Ventures, Burrill & Company and Zohar Gilon

Type of Technology(ies): A biomass treatment process made of proprietary extraction and separation technologies combined with concentrated hydrochloric acid hydrolysis, which deliver near to maximum yields in high grade cellulosic sugars, lignin and tall oils.

Feedstocks: Concentrated hydrochloric acid will hydrolyze any biomass. So far the company has proven it can efficiently extract sugars, lignin and tall oils from softwood, hardwood, bagasse, and corn stover

Products (e.g. ethanol, biobutanol, biodiesel, renewable diesel, renewable jet fuel, power, organic acids, bioplastics etc)

Refined cellulosic sugars suitable for any fermentation process or chemical conversion

Unaltered, dry lignin Tall oils

Product Cost (if applicable - per US gallon): (Costs per US gallon for fuels, costs per pound for chemicals and/or biomaterials. If you do not manufacture or have long-term stable feedstock pricing, please use the latest December futures contract pricing for traded feedstocks, or $55/ton for untraded biomass – or provide notes on your own feedstock pricing assumptions).

Offtake partners (if applicable)
Undisclosed term sheets

3 Top Milestones for 200911: Successful Pilot Scale demonstration of all process unit operations Successful test results of products by potential users 1st definitiveagreementwithofftakepartner

3 Major Milestone Goals for 201214: Building and commissioning of first commercial scale plant Demonstrate economics at commercial scale Site selection and financing for the 3 large commercial plants, Offtake partners for HCL CleanTech’s value added lignin

Business Model: (e.g. owner-operator, technology licensor, fee-based industry supplier,
investor) Owner and operator

**Competitive Edge(s):**
Highly refined cellulosic sugars suitable for all fermentation and chemical processes
Economics competitive with corn sugars Superior LCA vs. corn sugars High quality lignin products

**Research, or Manufacturing Partnerships or Alliances.**
Virent (BIRD grant): HCL CleanTech cellulosic sugars to produce gasoline, jet-fuel and plastics, LS9 (DOE grant): Integrated cellulosic biomass refinery to produce diesel and chemicals

Stage (Bench, pilot, demonstration, commercial) Demonstration, Engineering first commercial plant

**Website URL:** [www.hclcleantech.com](http://www.hclcleantech.com)

**Chief Executive Officer:** Philippe Lavielle
Virent

Address:
3571 Anderson Street
Madison, WI 53704

Year Founded:
2002

Company description:
Virent is in the business of replacing crude oil by applying clever chemistry to create the fuels and chemicals the world demands using a wide range of naturally-occurring, renewable resources.

Virent’s patented technology features catalytic chemistry to convert plant-based sugars into a full range of products identical to those made from petroleum, including gasoline, diesel, jet fuel, and chemicals for plastics and fibers.

Virent’s products are ‘drop-in’ replacements that enable full utilization of existing logistics infrastructure without blending limitations.

The development of Virent’s BioForming® technology platform is supported through our strategic partners, including Shell, Coca-Cola, Cargill, and Honda, as well as 130 employees based in Madison, Wisconsin. The company has received several grants from the U.S. Departments of Commerce, Energy and Agriculture and has been recognized with many honors, including the World Economic Forum Technology Pioneer award, and the EPA’s Presidential Green Chemistry Challenge Award. Virent has a large intellectual property folder, with over 45 issued patents and over 150 pending patent applications, covering 28 different technology families.

Major Investors (if a public company, please provide trading symbol and exchange).

Royal Dutch Shell
Cargill Ventures
Honda Strategic Ventures
Venture Investors LLC
Stark Investments

3 Top Milestones for 2009-11

1. Virent and Shell start production at the world’s first biogasoline demonstration plant in Madison, Wisconsin. The plant produces up to 10,000 gallons per year of biogasoline.
2. Virent produces biogasoline from corn stover and pine harvest forest residuals, as a recipient of the U.S. Department of Energy’s (DOE) February 2010 grant to the National Advanced Biofuels Consortium (NABC).

3. Virent produces Paraxylene from plant sugars, producing the missing 70% needed to create 100% renewable PET packaging. In 2011, Virent and Coca-Cola announce partnership to use Paraxylene to make 100% plant-based bottles.

3 Major Milestone Goals for 2013-15

1. Improve our biomass deconstruction capabilities of corn stover, wood and bagasse to demonstrate cost effective conversion to chemicals and drop-in fuels.

2. Form additional strategic partnerships in the chemical supply chain to accelerate commercialization.

3. Gain necessary financial and partnership commitment to construct and commission initial commercial plant.

Business Model: (e.g. owner-operator, technology licensor, fee-based industry supplier, investor)
Owner/operator and licensing within strategic relationships.

Competitive Edge(s): Virent’s BioForming technology provides numerous competitive advantages:

Premium Liquid Fuel Products: Virent’s renewable hydrocarbons can be used as chemicals or blended to make premium quality gasoline, diesel and jet fuels with global market acceptance. Virent’s fuel products can readily enter the market using existing pipelines and fuel pumps to power today’s vehicles at high blends.

Feedstock Flexibility: Unlike other biofuel companies which are limited to using a small number of conventional feedstocks, Virent is able to use a wide variety of cellulosic feedstocks. Sugar mixtures, including 5 and 6 carbon sugars, disaccharides, and other water soluble polysaccharides derived from sugar and energy crops, as well as agricultural and forestry residues, are possible feedstocks. This flexibility translates into more biomass options and lower input costs.

Robust Catalytic Process: Catalysts provide increased productivity due to faster chemical reactions, proven process reliability, reduced energy requirements, and demonstrated scalability to large production volumes. In contrast to biological processes, which depend on living enzymes or microbes, using catalysts allows Virent the capability of utilizing variable feedstocks and of producing a range of fuel and chemical products.
Cost-Competitive Biorefinery Solution:
Feedstocks and end products can be optimized based on local market conditions. This fast and continuous (versus batch) process lowers capital expenditures, while low energy requirements reduce operating costs. Together, these attributes provide a biorefinery solution with a broad mix of high value products and attractive market returns.

The BioForming process is a practical biorefinery alternative that can speed the use of nonfood plant sugars as an energy source in place of petroleum, thus decreasing dependence on fossil hydrocarbons while minimizing the impact on global water and food supplies. Virent’s ability to produce hydrocarbon products that are both sustainable and economical is truly transformative.

Research, or Manufacturing Partnerships or Alliances.
Strategic Partners: Shell began collaborating with Virent on liquid fuels research and development in 2007 and invested in Virent in 2010, positioning the BioForming process for commercial deployment. In parallel, Coca-Cola has been funding development of the Virent process since 2011 for cost effective manufacture of Paraxylene. Cargill has provided key input on feedstocks for the BioForming process since its original investment in 2007. Finally, Honda has provided engine testing services and guidance of their requirements and outlook on transportation fuels and related policy issues.

Other Partners on Government Grants: Virdia, NABC, NREL, Catchlight Energy, Iowa State University, BP, Pacific Northwest National Laboratory, Washington State University, Pall Corporation, Albemarle, and TESORO.

Strong Intellectual Property Portfolio
Virent has a strong intellectual property folder, with over 45 issued patents and over 150 pending patent applications, covering 28 different technology families. These patents, coupled with a strong trade secret portfolio, protect every phase of Virent’s technology, including methods, processes, the systems in use, and the activities undertaken to produce products. The ongoing issuance of patents, along with prudent management of new and existing filings, is vital to Virent’s competitive advantage. The strength of Virent’s IP portfolio is confirmed by the industry knowledgeable strategic collaborators that have funded Virent both through investment and development dollars.

Stage (Bench, pilot, demonstration, commercial)
Pilot/Demonstration

Website URL:
www.virent.com

Chief Executive Officer:
Lee Edwards
Business development or sales contact:
Megan Weber, megan_weber@virent.com

Contact for follow up information: (Name, title, phone, email)
Megan Weber
Associate Marketing Coordinator
megan_weber@virent.com
Wetzel Oil Inc.

Address: 19309 68th Ave. S. Ste 110 Kent, WA 98032

Year Founded: 2010

Annual Revenues: 1.5 mil

Company description: WOI sells technology that makes Renewable and Biodiesel out of sewage and other bio-feedstocks. WOI is a producer, but for demonstrating our technology.

Major Investors (if a public company, please provide trading symbol and exchange). Privately Held for now. IPO planned in 2 years. Private investors and shareholders.


3 Major Milestone Goals for 2012-14. 4 plant expansion planned. Production planned to reach 1 million barrels per month. Open Office in Ukraine.

Business Model: (e.g. owner-operator, technology licensor, fee-based industry supplier, investor). Technology Company with proven scale production models.

Competitive Edge(s): WOI Technology enables the use of cheap, abundant feedstocks to make the same Biodiesel and Renewable Diesel. Concept is proven. Production is actual.

Research, or Manufacturing Partnerships or Alliances. WOI desires and is seeking a larger, strategic partner.

Stage (Bench, pilot, demonstration, commercial) Commercial.

Website URL: www.wetzeloil.com

Chief Executive Officer: Timothy Wetzel

Business development or sales contact: Timothy Wetzel

Contact for follow up information: (Name, title, phone, email) Timothy Wetzel, CEO timw@wetzeloil.com. (cell) 206-384-9119 office: 253-277-2695
**Project information:** Las Vegas Nevada

Materials or products produced
Biodiesel and Renewable Diesel

Capacity (Millions of US gallons per years)
25 million barrels per year

Year, month in service (planned or projected)
Fall 2013

Status: (Open, Under Construction, Planned)
Planned and funded.

Feedstock: Sewage Biosolids, wvo and seed oils.

Processing technology (e.g. advanced fermentation, enzymatic hydrolysis)
WOI Proprietary IP: EXIMO and STF (Sewage To Fuel)

Project notes, if any
STF technology resolves many issues prohibiting typical biodiesel producers to supply large scale users such as airlines, trains and other very large users. Cheap and abundant feedstock like sewage biosolids, translates into low production costs and the ability to supply large end users.

**Product information:** SnxF#2, SnxF#3, SnxF#4-6, SnxF Jet A

Product Description:
SnxF Jet A and all SnxF fuels can meet ASTM 975 and ASTM 6751. SnxF Jet A weights only 5.2 lbs and has greater CFPP qualities than Bio-versions using seed oils. Cheap to produce and meets all environmental requirements. Drop in and go. NO food for fuel argument. Ethanol producers can derive chemicals from the WOI STF technology.

Product Applications: Airloines, Cruise Ships, Trains, all heating oil users, all grades of diesel users. All diesel cars, trucks, on & off road.

**Unique Features** (i.e., *what separates this product from the competition, whether bio-based or incumbent fossil-based products — e.g. cost, performance features*). The cost to produce SnxF is so cheap and it comes from sewage biosolids, that are abundant and constant in their supply. Best of all, sewage biosolids are not a commodity! Cheaper and more abundant that all of the wvo and seed oils combined! All SnxF fuels are drop in ready.

**Feedstocks and bio-based content** (e.g. “20% soy-based”) 20% to 75% Chemical based.
Wholesale or retail Product price: (if applicable) Presently, WOI sells SnxF#2 on-road for $.50 less per gallon than on-road pump price. WOI sells SnxF#2 for $3.99 per gallon.

Parity price, e.g. competitive with $XX oil: (if applicable, in BPOE, US$) Chevron #2 fossil diesel in our area is $4.65 per gallon.

Website URL: www.wetzeloil.com
YSI Life Sciences

Based in: Ohio

Business:
YSI Life Sciences is a part of YSI Incorporated. Founded in 1948 and formerly known as Yellow Springs Instrument Company, YSI develops and manufactures scientific instruments, sensors and systems that serve a variety of scientific, environmental, and industrial markets worldwide.

The YSI method uses immobilized enzyme electrodes to measure the glucose and xylose present. 13 µL of sample are automatically aspirated and delivered to the electrode chamber. Two electrodes develop signals proportional to the glucose and xylose present. Results are printed, displayed and stored after about 30 seconds. The system automatically clears sample from the electrode chamber and the next sample is ready to run. Turn around time is typically under two minutes.

Model:
Service provider

Past milestones:
In 2009, launched xylose sensor, an enzyme electrode membrane for use on the existing YSI 2700 SELECT and YSI 7100 MBS. Xylose and glucose sensors are configured in the same electrode chamber allowing simultaneous measurement of these sugars in one-minute.

Metrics:
The YSI enzyme electrode technology provides accurate one-minute results with minimal sample preparation.

Website:
www.ysilifesciences.com
ZeaChem

Address: 215 Union Blvd., Suite 500, Lakewood, CO 80228

Year Founded: 2002

Company description: ZeaChem is a developer of highly efficient biorefineries for the conversion of cellulosic biomass into economical and sustainable advanced biofuels and bio-based chemicals. Our indirect approach leapfrogs the yield and carbon dioxide (CO2) problems associated with traditional and cellulosic-based processes. ZeaChem’s patented process offers the highest yield at the lowest cost, with the lowest fossil carbon footprint of any known biorefining method.

Major Investors (if a public company, please provide trading symbol and exchange).
Firelake Capital
Globespan Capital Partners
Mohr, Davidow Ventures
PrairieGold Venture Partners
Valero Energy Corporation (NYSE = VLO)
See: http://www.zeachem.com/about/investors.php

3 Top Milestones for 2010-12

1. 2010: ZeaChem broke ground on its 250,000 gallon-per-year integrated biorefinery (IBR) in Boardman, Oregon. The core facility enabling the production of bio-based chemicals is operating and construction of the cellulosic ethanol project will be completed in 2012. The facility scales up the C2 product platform including acetic acid, ethyl acetate and cellulosic ethanol. Additionally, ZeaChem announced it successfully scaled up its fermentation process 10,000x from lab scale, the successful concentration of the fermentation broth to glacial acetic acid, and the conversion to commercial grade ethyl acetate.

2. 2011: ZeaChem has entered into strategic partnerships along the biorefinery value chain that advance the business strategy. ZeaChem signed a long-term feedstock agreement with GreenWood Resources to be the primary feedstock supplier to ZeaChem’s first commercial biorefinery (see Feedstocks). This is a significant milestone as ZeaChem develops its first commercial production facility. In addition, ZeaChem announced a binding multi-year joint development agreement (JDA) with Procter & Gamble (NYSE: PG) for the production of “drop-in” bio-based chemicals beyond the C2 product platform. These bio-based chemicals will be used in products and packaging as P&G advances toward its sustainability goal of 25% renewable and recycled content by 2020. Also, ZeaChem announced a strategic alliance with Chrysler Group LLC to accelerate the development and market adoption of advanced cellulosic ethanol.
3. 2012: The USDA announced a conditional loan guarantee of $232.5MM for ZeaChem’s first commercial biorefinery. The conditional commitment enables the financing and construction of ZeaChem’s commercial facility that will produce bio-based fuels and chemicals from woody biomass and agricultural residues. The facility is expected to have capacity of 25 million or more gallons-per-year (GPY). It will be located at the Port of Morrow in Boardman, Ore., adjacent to ZeaChem’s 250,000 GPY integrated demonstration biorefinery.

3 Major Milestone Goals for 2013-15

1. Demonstration biorefinery: ZeaChem will begin production of cellulosic ethanol by the end of 2012 from its 250,000 GPY integrated demonstration biorefinery in Boardman, Oregon. The facility will utilize woody biomass and agricultural residues. In 2013, the facility will be further expanded to convert cellulosic ethanol into bio-based jet and diesel fuels.

2. First commercial biorefinery: ZeaChem is actively developing its first commercial biorefinery, to be located adjacent to the demonstration plant in Boardman, Oregon. The facility has secured 100% of the feedstock from primary feedstock partner GreenWood Resources which will be supplemented by locally available agricultural residues. The facility will have capacity of 25MM or more GPY. The USDA announced a conditional loan guarantee for the project which will enable the financing and construction of the facility beginning in 2013.

3. Platform extensions: In addition to expanding the C2 product platform at the demonstration biorefinery to enable the production of bio-based jet and diesel fuels, ZeaChem is also scaling up its next product platform. At this time, the C3 platform is being developed at the lab scale. Next steps include pilot and demonstration scale deployment. The C3 platform includes propionic acid, propanol and propylene for bio-based plastics and other end uses.

Business Model: (e.g. owner-operator, technology licensor, fee-based industry supplier, investor)
Owner-operator and technology licensor

Competitive Edge(s): Several factors give ZeaChem a competitive edge:

1. Feedstock flexibility: ZeaChem’s technology can utilize globally-available, low-cost feedstocks including wood, grasses, and agricultural residues. ZeaChem’s feedstock strategy is to utilize sustainable dedicated energy crops, which allows for geographic diversity of biorefinery locations and to supplement with local residuals (ag/forest).

2. The hybrid process: ZeaChem incorporates biochemical and thermochemical processes to deliver the highest theoretical yield of any biorefinery technology, a 40%
advantage compared to other processes. Naturally occurring bacteria, acetogen, do not produce CO2 during fermentation. This significant yield advantage leads to competitive economics. ZeaChem uses proven technology and process components integrated in a new and novel way, which significantly reduces scale-up risk.

3. Product flexibility: ZeaChem’s technology can produce C2 (acetic acid, ethyl acetate, ethanol, ethylene) and C3 (propionic acid, propanol, propylene). ZeaChem biorefineries will be capable of producing products that will yield the best margin. Should market conditions change (policy, economics, etc), ZeaChem facilities will have the flexibility to change the products produced, providing valuable flexibility that is not available to facilities captive to a single/limited market. Such flexibility also establishes opportunities for multiple product off-take partners.

Research, or Manufacturing Partnerships or Alliances.

Hazen Research (www.hazenusa.com)
Burns & McDonnell (http://www.burnsmcd.com/portal/page/portal/Internet)
Koch Modular Process Systems, LLC (www.modularprocess.com)
Sulzer Chemtech Ltd. (www.sulzerchemtech.com)
Andritz
Continental Technologies
Chrysler

USDA’s National Institute of Food and Agriculture (NIFA) through the Agriculture and Food Research Initiative (AFRI) Regional Coordinated Agricultural Project (CAP) Consortium, which includes University of Washington, GreenWood Resources, Oregon State University, Washington State University, the University of California, Davis, University of Idaho, and the Agricultural Center for Excellence

USDA’s and DOE’s joint Biomass Research and Development Initiative (BRDI) Consortium, which includes University of Hawaii, Oregon State University, Washington State University, Hawaiian Commercial and Sugar Company, and Hawaii BioEnergy LLC

Stage: (Bench, pilot, demonstration, commercial)

C2 Bench - completed
C2 Pilot - completed
C2 Demonstration - intermediate chemical production facility completed, cellulosic ethanol year-end 2012
C3 Bench - underway

Website URL: www.zeachem.com

Chief Executive Officer: Jim Imbler, President & CEO
Business development or sales contact: Bob Walsh, Chief Commercial Officer
Project information

For each existing or planned project please complete

Location: Boardman, Oregon

Materials or products produced: C2 product platform (acetic acid, ethyl acetate, ethanol, ethylene, jet, diesel)

Capacity (Millions of US gallons per years): 250,000 GPY (demonstration), 25 million GPY (commercial)

Year, month in service (planned or projected): Demo: 2012;
Status: (Open, Under Construction, Planned): Demo: Open; Commercial: Planned

Feedstock: In May 2011, ZeaChem announced an agreement for a long-term binding term sheet with GreenWood Tree Farm Fund (GTFF), managed by GreenWood Resources (GWR), to supply hybrid poplar woody biomass for ZeaChem's first commercial cellulosic biorefinery. GreenWood’s hybrid poplar is Forest Stewardship Council certified.

Processing technology (e.g. advanced fermentation, enzymatic hydrolysis):

ZeaChem combines the best of biochemical fermentation and thermochemical processes into a hybrid process that achieves 40% higher yield than other cellulosic processes. ZeaChem's patented biorefining process uses an acetogen - a species of bacteria that naturally digest the tough carbon chains of cellulose - to extract the maximum amount of energy available from the feedstock. ZeaChem offers the highest yield, lowest production cost and lowest carbon emissions profile of any known biorefining process.

Project notes, if any: Production of acetic acid and ethyl acetate is underway. Will begin producing cellulosic ethanol by year-end 2012.

EPC partner, if any: Burns & McDonnell
Product information: Carbon chain platforms

**ZeaChem Carbon Chain Product Groups**

<table>
<thead>
<tr>
<th>C2 Chain</th>
<th>C3 Chain</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Acetic acid</td>
<td>• Propionic acid</td>
</tr>
<tr>
<td>• Ethyl acetate</td>
<td>• Propanol</td>
</tr>
<tr>
<td>• Cellulosic Ethanol</td>
<td>• Propylene</td>
</tr>
<tr>
<td>• Ethylene</td>
<td>• Polyethylene</td>
</tr>
</tbody>
</table>

### Product Applications:
replacement biofuels and bio-based chemicals for traditional petroleum-based products

### Unique Features
(i.e., *what separates this product from the competition, whether bio-based or incumbent fossil-based products – e.g. cost, performance features*).

A differentiator of ZeaChem's technology is the ability to produce a range of products to serve a variety of market sectors from a single facility. Within each product platform, ZeaChem will produce various intermediate chemicals and biofuels. Financially, bio-based chemicals offer major new market opportunities and value to the company. At this time, ZeaChem is deploying the C2 product platform which includes acetic acid, an intermediate chemical building block, and ethyl acetate, which is used in paints, lacquers and solvents and has a market value of $2.2B. The next product platform that will be scaled up is the C3 product chain which includes the $95B propylene market for bio-based plastics.

### Feedstocks and bio-based content (e.g. “20% soy-based”)

The ZeaChem process is feedstock flexible and can accept feedstock from a variety of sources, including hardwood, softwood, switch grass and corn stover.

ZeaChem's analysis has shown the use of short rotation hybrid poplar trees for feedstock initially offers the lowest cost per bone dry ton (BDT)/acre/year. The feedstock inventory is stored on the stump until it is needed for conversion into biofuel or a chemical product, eliminating storage concerns. Short rotation hybrid poplar trees can be harvested as often as every three years, and require replanting only once every five harvests. Maintaining this high density energy crop approach minimizes the transportation costs associated with delivery to the plant.

ZeaChem will secure long-term, fixed price contracts for dedicated energy crops, such as poplar, and supplement with agricultural residues available from the surrounding area.
Wholesale or retail Product price: *if applicable*
N/A

Parity price, *e.g. competitive with $XX oil: if applicable, in BPOE, US$*

ZeaChem products will compete with petroleum at $50/barrel. Cellulosic ethanol production costs will be less than $1/gallon. (Based on mature technology)

Website URL: http://zeachem.com/

Product photo URL: *if available*  N/A

Head of sales,  Bob Walsh, Chief Commercial Officer, (650) 543-8129,