ALGENOL BIOFUELS
Harnessing the sun to fuel the world

CO₂ Policy/Regulations and Climate Change
ABS, Washington DC -- 2015
Recent Recognition

- **1st Presidential Climate Change Award**
  Green Chemistry Challenge – July 2015

- **Global Industry Leadership Award**
  Biofuels - PLATTS 2014

- **Voted #1 Hottest Biofuels Company in the United States and #3 Worldwide**
  Biofuels Digest 2014
Algenol Life Cycle Benefits

Algenol’s pathway reduces Green House Gas (GHG) emissions by 69% compared to gasoline, according to the official EPA pathway approval.
High Yield, Low Cost, Scalable

**4 most important fuels**

<table>
<thead>
<tr>
<th>Fuel</th>
<th>Cost per gallon</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethanol</td>
<td>$1.30</td>
</tr>
<tr>
<td>Gasoline</td>
<td></td>
</tr>
<tr>
<td>Diesel</td>
<td></td>
</tr>
<tr>
<td>Jet</td>
<td></td>
</tr>
</tbody>
</table>

**OpEx ≤ $1.30 per gallon each**

**Feedstock Conversion**

1 tonne of CO\(_2\) becomes 144 gallons of fuel:
- 125 gallons of ethanol
- 19 gallons of diesel, jet fuel, and gasoline

**Necessary Inputs Are Abundant:**
- Sunshine
- CO\(_2\) from industrial sources
- Saltwater
- Spent algae becomes diesel, jet fuel, and gasoline

**Productivity**

Unique Platform Strain:

> 8,000 TGOLF\(^{(1)}\) per acre-year

**Comparison to Biofuels**
- 420 corn ethanol
- 860 Brazil sugarcane
- < 500 cellulosic

**Direct to Ethanol® Does Not Require:**
- Farm land
- Food crops
- Fresh water
- Mandates

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\(^{(1)}\) Total Gallons of Liquid Fuel
Algenol’s Feedstock Advantage

Flue Gas CO\(_2\), Saltwater, Sunshine

- Algenol is the only demonstrated process that monetizes CO\(_2\) to produce useful products
- Direct use of flue gas without chemical carbon capture and compression
- Utilizing CO\(_2\) as the primary feedstock reduces commodity risk and turns a liability into a revenue generating asset
- Carbon converted to fuels from flue gas at a profit could become the norm for CO\(_2\) emitters
- Combination of profit plus real carbon reductions provides a strong incentive for broad, early market adoption
- Saltwater is not scarce, only by-product is fresh water, we can make more fresh water than fuels
- Sunshine is abundant across the temperate zones of the globe
Disruptive Core Technology

Algenol's Direct to Ethanol® process has three core components:

**World's Most Productive Algae Platform**

- Proprietary enhanced algae make ethanol and biomass **directly** from CO₂, water, and sunlight
  - 8,000 gallons per acre per year
  - 85% of the CO₂ is converted into products

**Specialized VIPER™ Photobioreactors**

- Algae are grown in saltwater contained in proprietary PBRs that are exposed to the sun and are fed CO₂ and nutrients
  - A production cycle runs 4 weeks
  - Afterwards, the spent algae are separated from the water-ethanol mixture

**Energy Efficient Downstream Processing**

- Water-ethanol mixture is sent to proprietary downstream processing equipment which separates and concentrates it into fuel grade ethanol
- Spent algae are processed into a high grade green crude that can be refined into diesel, gasoline, and jet fuel
Simple CO₂ Sourcing Process

Algenol’s process to source CO₂ from emitters is simple and rapidly deployable.

- Algenol’s technology is designed to be co-located next to an emissions source
- Acquiring CO₂ from the emitter is straightforward and rapidly deployable process requiring minimal capital expense
- Process effectively boils down to “sticking a straw into the emissions stack”
- Over 85% of CO₂ is converted into fuel products
Algenol’s $1 a Tonne Paradigm Shift – CO₂ Monetization

Algenol is the only solution that monetizes CO₂ through utilization, drastically altering the current paradigm by turning a liability into a revenue generating asset.

Current CO₂ Paradigm vs. Algenol’s Solution

- Algenol pays emitters $1 a ton for industrial CO₂, utilizing it as a revenue generating feedstock.
- Current CCS plans could cost electric customers more than $50 billion per year.
- Displaces fossil fuels, providing real CO₂ reduction.
- Policymakers achieve climate goals, consumers avoid $0.04 per kW increase on their bill.
- EOR with captured CO₂ could struggle with cheap oil prices.

Over $75/tonne swing in financial benefits to emitters and ratepayers.

(1) Carbon Disclosure Project: Use of internal carbon price by companies as incentive or strategic planning tool
(2) McKenzie & Company: Pathways to a Low-Carbon Economy
Algenol’s $1 a Tonne Paradigm Shift – CO₂ Monetization

2 tonnes of CO₂
At $1 / tonne

6 Barrels of Ethanol
288 Total Gallons of Fuel Produced

+ 1 Barrel of Bio-Crude

Algenol makes 7 barrels of fuel from $2 of CO₂

Policymakers achieve climate goals, consumers avoid charges, Algenol produces a valuable product
Specialized, Scalable Photobioreactors

Easy to deploy in America’s, Asia, and MENA

Plastic bags hold algae in saltwater culture, and distribute light to maximum number of cells
Takes up 95% LESS land than corn ethanol 8000 vs 420 gallons per acre
Takes up 99% LESS land than cellulosic ethanol 8000 vs 70 gallons per acre
A 2,000 acre Algenol facility is equal to planting more than 40,000,000 trees

- Equivalent to 125,000 acres of average US forest
- 1.2 tonnes of CO₂ per acre-year consumed by these trees. Algenol consumes 75 tonnes/ac-yr
- Based on EPA Estimates
Algenol’s modular design greatly simplifies industrial deployment

- The first of these modules is currently operating in Fort Myers
- Algenol will scale up its industrial roll-out by co-locating repetitive commercial modules

2,000 ACRES = 400 x 5 ACRE MODULES

5 ACRE MODULE
18,000 Gen 2 PBRs
First operating commercial IBR converting CO2 into fuels

200 dedicated people
100 scientists
44 patents
9 buildings
9 years
Algenol will buy your Coal Flue Gas
Unprecedented Global Action on CO₂

National Oceanic and Atmospheric Administration reports in March 2015, the global monthly average for CO₂ hit 400.83 parts per million, reaching levels that have not been seen in about 2 million years.

Global Action

- President Obama and Xi announced an historic agreement in November 2014 to reduce carbon emissions in the US and PRC.

- August 3, 2015, President Obama implemented the Clean Power Plan which establishes rules to reduce emissions from EGU’s, reducing CO₂ 23% from 2005.

- Last week Xi announced China will implement Cap and Trade in 2017. Establishing a price on CO₂ to halt the growth of emissions by 2030. In addition, Xi announced a “green dispatch” program designed to create a price incentive to produce power from low carbon sources. End subsidy program on “highly polluting projects”

- In June 2015, chief executives of Shell, BP, Total and 3 others call for a price on carbon in a letter to United Nations.

- Significant momentum leading to COP21.

- EPA allows for adoption of carbon utilization in final Clean Power Rule.
The world is taking action

<table>
<thead>
<tr>
<th>Country</th>
<th>Region</th>
<th>Greenhouse gas emissions including LUCF 2012 (MtCO2e)</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>Asia</td>
<td>10684.29</td>
</tr>
<tr>
<td>United States of America</td>
<td>Northern America</td>
<td>5822.87</td>
</tr>
<tr>
<td>European Union (28)</td>
<td>Europe</td>
<td>4122.64</td>
</tr>
<tr>
<td>India</td>
<td>Asia</td>
<td>2887.08</td>
</tr>
<tr>
<td>Russia</td>
<td>Europe</td>
<td>2254.47</td>
</tr>
<tr>
<td>Indonesia</td>
<td>Asia</td>
<td>1981</td>
</tr>
<tr>
<td>Brazil</td>
<td>Latin America and the Caribbean</td>
<td>1823.15</td>
</tr>
<tr>
<td>Japan</td>
<td>Asia</td>
<td>1207.3</td>
</tr>
<tr>
<td>Canada</td>
<td>Northern America</td>
<td>856.28</td>
</tr>
<tr>
<td>Mexico</td>
<td>Latin America and the Caribbean</td>
<td>748.91</td>
</tr>
<tr>
<td>Australia</td>
<td>Oceania</td>
<td>685.05</td>
</tr>
</tbody>
</table>

http://cait.wri.org/pledges/#/
Recent Recognition

- Participant in first US Presidential Trade Mission to China with both DOE and DOC
- Game-changing group to promote clean power generation to reduce CO$_2$ emissions in China
Ideal growing conditions in these parts of the world

- Grows very well at high temperatures and intense sunlight
- High salinity tolerance
- 3–45°C temperature range
- Marginal land ideal, not farm land
- Vertical VIPER™ PBRs allow deployment on uneven terrain with minimal land movement cost

Lee County, Florida
Algenol shareholders have invested over $225 million Plus $10 million from Lee County, and $25 million from US Department of Energy to build the IBR

Central Florida
Algenol is in advanced discussions with two large CO₂ emitters in Florida to co-locate Phases 1 thru 4 of commercial facilities in Central Florida

BioFields, Mexico
Biofields owns approximately 42,000 acres of land adjacent to an electric power plant on the Pacific coast of Mexico (with regulatory clearance and environmental permits to build a biorefinery)

China
Zhongyuan New Energy (Fujian, PRC), commercial production and distribution

Reliance Industries, India
Reliance has completed a pilot plant duplicating the Florida IBR modules in India

Existing Global Reach

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With collaboration of our partner Reliance Industries, we have constructed a module in Gagva, India and inoculated with a commercial organism in November 2014.

- Achieved biomass growth as predicted by models.
- Out performs Florida by >10%
- Import permit received from Indian government for enhanced organisms.
- Second India federal import permit allows for full fuel producing organism
- In discussions for building next generation IBR
CO₂ Mitigation through Utilization

Monetize CO₂ feedstock from NG Flue Gas
CO₂ Mitigation through Utilization

Monetize CO₂ feedstock from NG Flue Gas
At the end of the test, the algae growth and fuel production exceeded medical grade CO$_2$

(We ran the test 6 times)
CO$_2$ Mitigation through Utilization

Monetize CO$_2$ feedstock from Coal Flue Gas

Direct flue gas from stack without additional filtration or treatment
CO\textsubscript{2} Mitigation through Utilization

Monetize CO\textsubscript{2} feedstock from Coal Flue Gas
Monetize CO₂ feedstock from Coal Flue Gas

At the end of the test, the algae growth and fuel production exceeded medical grade CO₂

(this is the first test but will be repeated several times)