

ALGENOL

BIOFUELS

Harnessing the sun to fuel the world®

Presentation to OMB
September 17, 2013



Algenol Corporate Overview

Advanced Industrial Biotechnology Company

- Headquartered in Florida
- European operations based in Switzerland
- Research labs in Fort Myers, Florida and Berlin, Germany
- 160 employees including 66 with advanced degrees



Fort Myers Research Labs

Commercializing Direct To Ethanol® Technology

- \$160M equity capital
- \$25M Department of Energy Integrated Biorefinery grant
- \$10M economic development grant from Lee County, FL



Process Development Unit

Fort Myers, FL Commercial Development Campus

- 60,000 ft² of Research and Development lab space
- 4 acre Process Development Unit (PDU)
- 36 acre demonstration IBR



Integrated Biorefinery

Technology Overview: Key Benefit Details

Productivity

>9,000 ethanol
gallons per acre-year

Cost

Opex target ≈
\$1.00/gallon

Sustainable Process



Necessary Inputs Are Abundant:

- Sunshine
- CO₂ from industrial sources - 1 tonne of CO₂ becomes 144 gallons of ethanol, diesel gasoline and jet fuel (125, 7, 6, 6)
- Saltwater is a feedstock, not freshwater
- For each gallon of ethanol produced - 3 gallons of fresh water can be provided

Comparison to other Biofuels



Direct to Ethanol® does not Require:

- Daily harvesting algae to produce ethanol
- Farm land or food crops
- Fresh water

Added Benefit:

- Waste algae becomes diesel, gasoline and jet fuel

Carbon Capture and Climate Change

CO₂ can be captured economically, because we will buy it

- Old arguments against CO₂ capture and climate change are now obsolete.
- It can cost \$30 - \$50 / tonne to capture CO₂ , and we will buy it for that much...

1 tonne of CO₂ becomes 144 gallons of 4 fuels

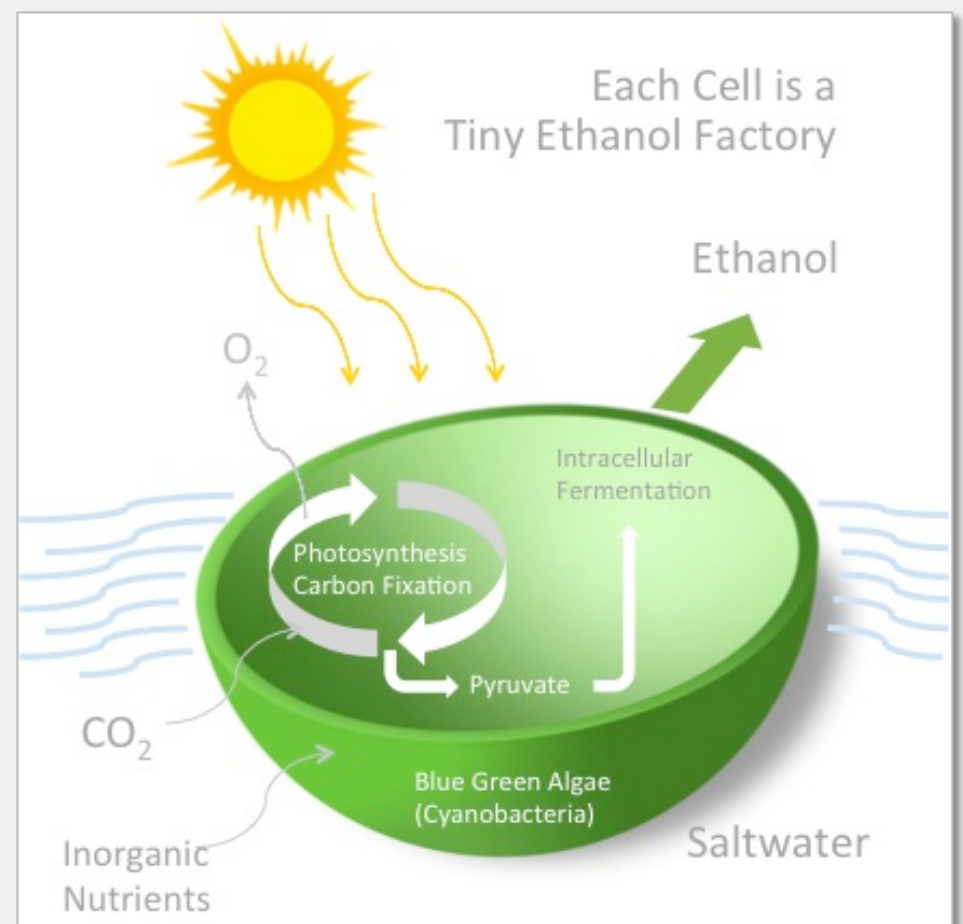
- 125 gallons of ethanol
 - (and ethanol can be converted into polyethylene)
- 7 gallons of diesel (ultra low sulfur diesel)
- 6 gallons of jet fuel
- 6 gallons of gasoline
- **1 tonne of CO₂ becomes 144 gallons of 4 fuels**
- 200 million tonnes of CO₂ – equivalent to 67 coal fired power plants - recycle into 29B gallons of ethanol, diesel and jet fuels, and gasoline



Technology Overview: Enhanced Algae

Algenol's Direct to Ethanol[®] process uses enhanced algae to produce ethanol

- Commercial strain of algae has been selected
- Vastly better at making biofuels
- Yields 25 times higher, therefore much lower cost and much less land
- On desert or marginal land
- Can let farmers use farmland to make food
- Will lower food costs
- We make 3 gallons of fresh water for every gallon of ethanol



Technology Overview: Photobioreactors

Low-cost mini-greenhouses are key to Direct to Ethanol® technology's success

- Plastic mini-greenhouses are modular and deployable at large scale





Integrated Bio-Refinery

Fort Myers, Florida

We are building as fast as we can

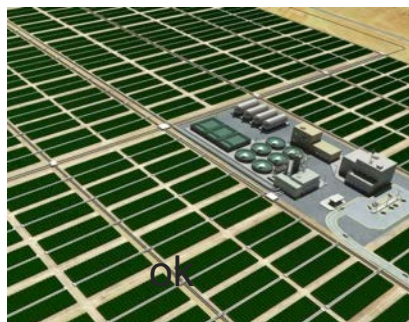


Integrated Bio-Refinery
Fort Myers, Florida

Power Plant



Algae-to-Fuels Commercial plants



CO₂ Requirements:

First Plant: 120,000 t/yr.
Standard Plant: 300,000 t/yr.

Fuels Production

Ethanol

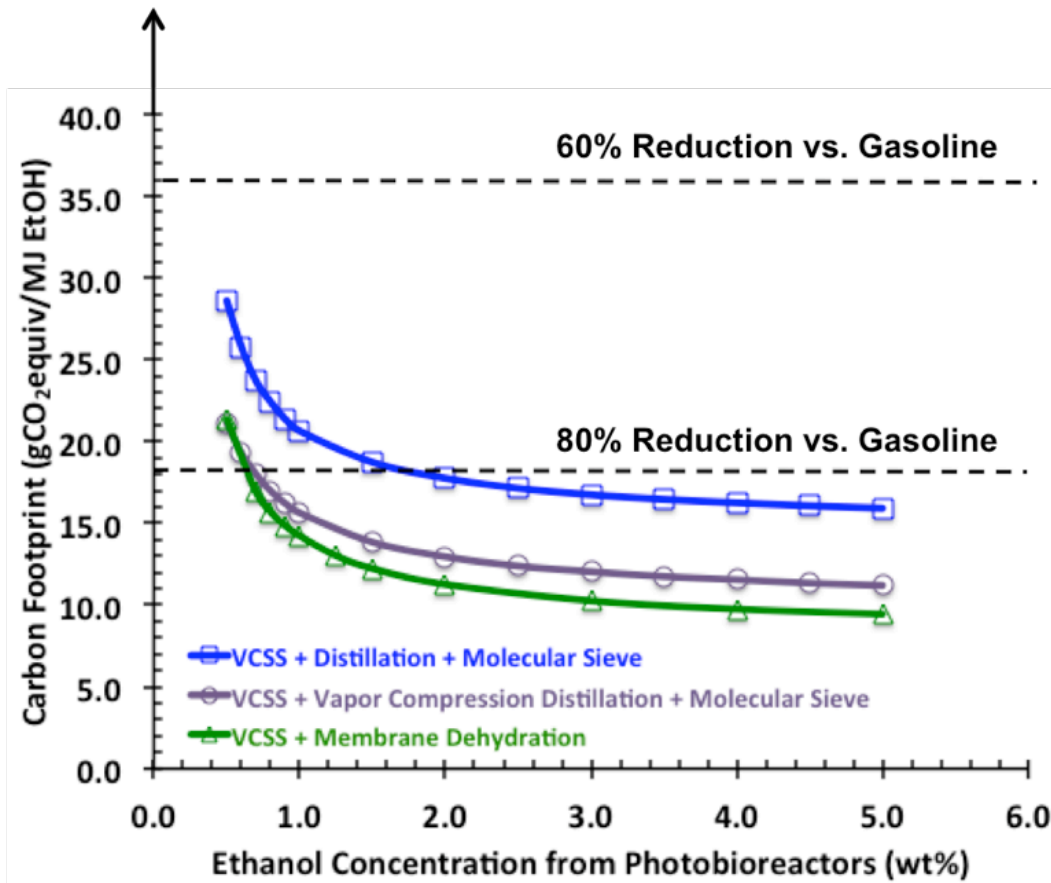
First Plant: 15 MGPY
Standard Plant: 37 MGPY



Distillate Fuels

First Plant: 2 MGPY
Standard Plant: 6 MGPY

Carbon Footprint Gasoline: 91.3 gCO₂/MJ

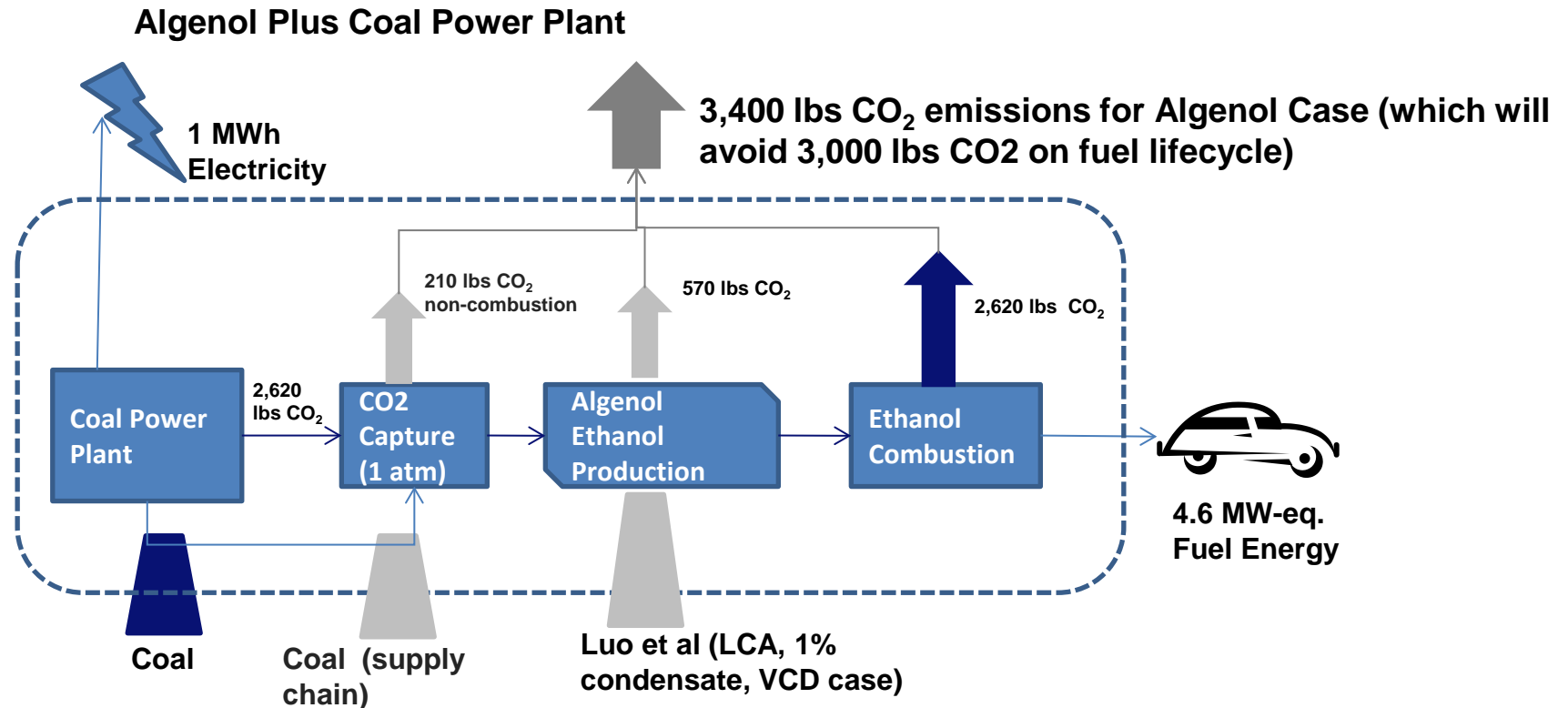


Life Cycle Analysis Appears in: D. Luo, Z. Hu, D. Choi, V. Thomas, M. Realff, and R. Chance, *Env. Sci. & Tech.*, 2010, 44 pp 8670–8677.

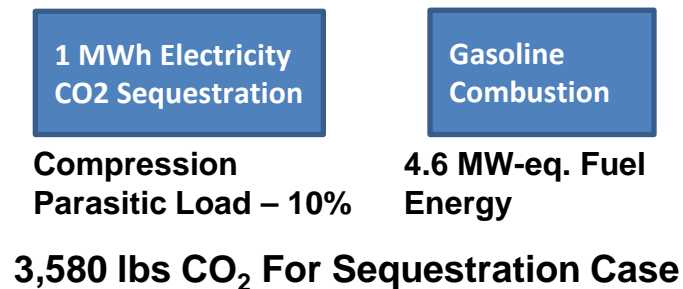
LCA study is designed to be evergreen

- Continuously updated as part of our DOE project.
- Renewable Fuel Standard requirements for greenhouse gas reduction are met in all scenarios studied.
- LCA is important part of the evaluation of new technology options.
 - Example: Polymer membrane technology (MTR), in combination with Algenol's process simulations and integration concepts, yields lower carbon footprint, as well as lower CAPEX and OPEX.
- **Carbon Capture and Reuse (CCR) scenarios can be evaluated for impact on carbon footprint**

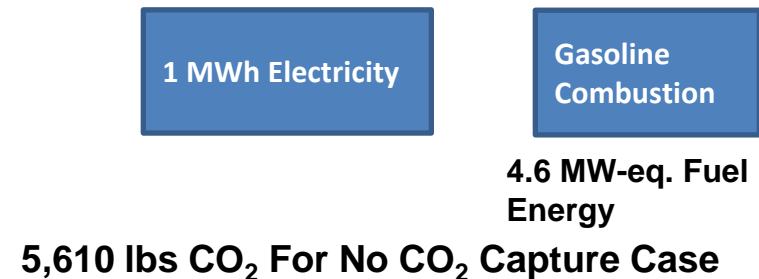
Capture vs. Reuse



Comparison to Sequestration (CCS)



Comparison to Status Quo (No Capture)



- Carbon Footprint: Direct To Ethanol® advantaged vs. CCS and greatly advantaged vs. Status Quo*

- The US government can/should play a role in maximizing industry incentives to capture carbon dioxide.
- We specifically request that EPA be explicit that new coal fired power plants be allowed to use CCR (reuse) in a par with CCS (sequestration) if the carbon emissions are within the target limits.
- We would also “ask” that:
 - ✓ CCR be considered in the upcoming EPA rules governing existing power plants.
 - ✓ CCR beyond Enhanced Oil Recovery (EOR) be fully concerned as an Administration priority in funding DOE & NETL.
 - ✓ The Administration should take a leadership in ensuring that IRS use a broad and flexible interpretation of their rules in assessing REIT status to renewable projects using CCR technologies.