



# Sapphire Energy <sup>TM</sup>

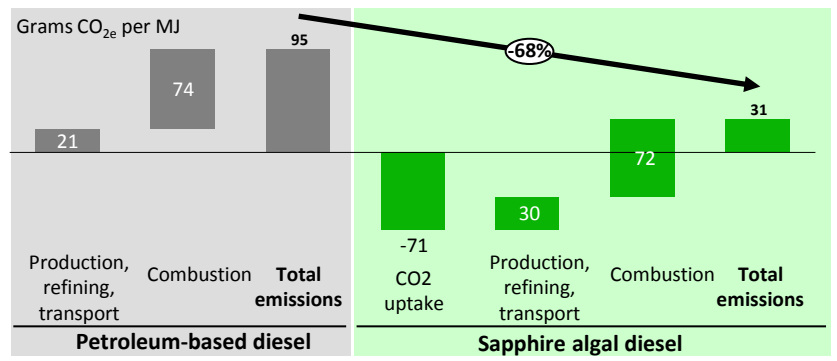
**Tim Zenk**

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October 11, 2012

# Algae is a superior renewable feedstock

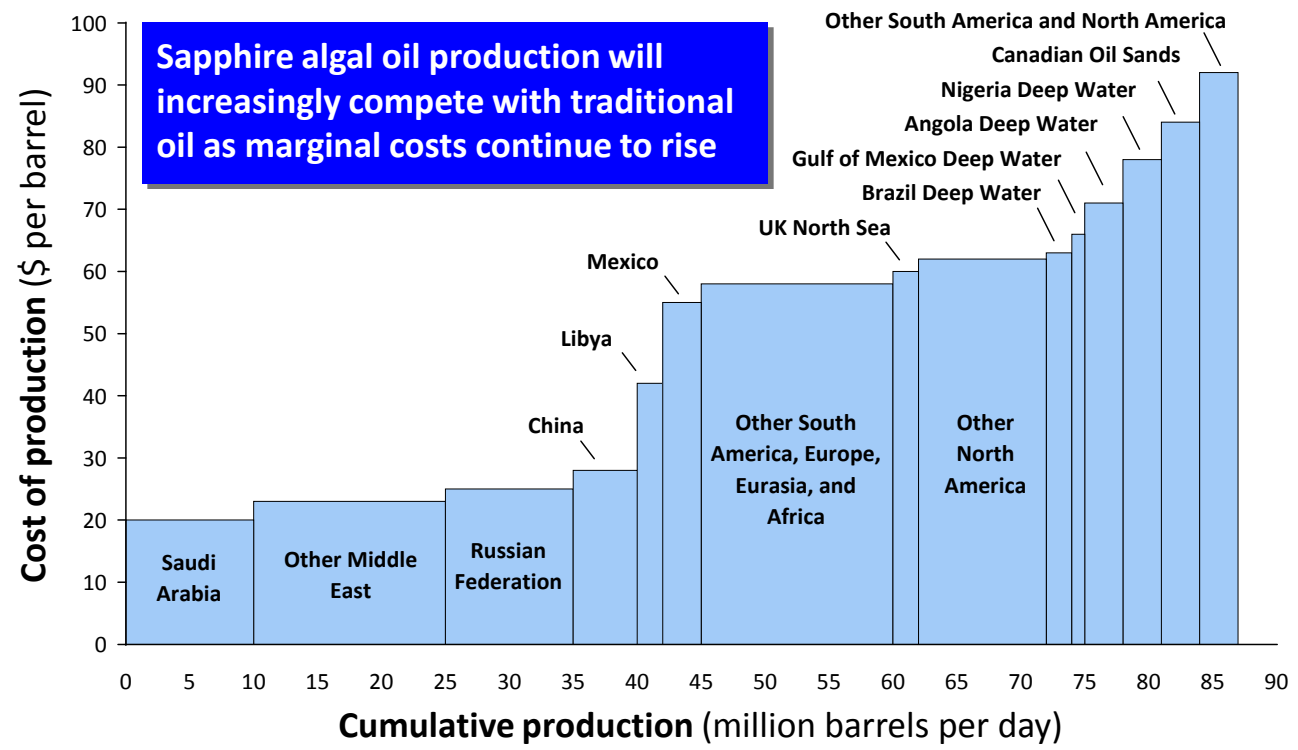
- Superior attributes of algae**
- **Scalable** to millions of barrels per day
  - **Cost competitive** with marginal crude oil production
  - **Completely fungible** with infrastructure and fleet
  - **Favorable life cycle** with respect to CO<sub>2</sub>
  - **Does not compete** with agricultural products, land, or water



Algae fuel can be grown on marginal land with saline water



## Oil supply marginal cost curve for 2008 WTI equivalent



# Recent forecasts indicate market demand will continue to drive oil prices above today's level

**Oil prices, historical and forecasted**  
Dollars per barrel (nominal)



Source: Energy Information Administration; Annual Energy Outlook 2012

# Sapphire has the most experience with large-scale production of photosynthetic algae

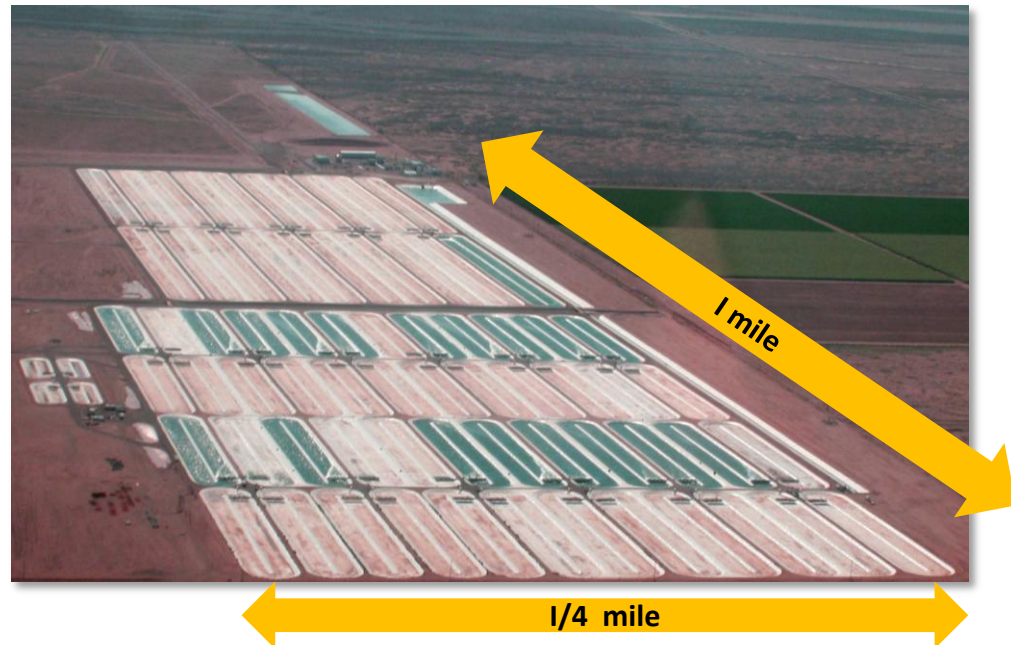
## Pilot technology facility

- **22-acre pilot facility** operated since 2009
- Over **180,000 hours** of large pond cultivation piloting



## Commercial demonstration facility

- Sapphire is currently finishing construction of the **world's first integrated algal-oil production facility**
- Operations will begin in Q2/Q3 2012
- First Commercial design complete in 2015/ construction begins 2016



# Extraction: concentrated algae is processed using proprietary technology to extract oil and nutrients

Sapphire uses a proprietary, innovative, solvent-based extraction system



Concentrated algae enters the extractor as a slurry



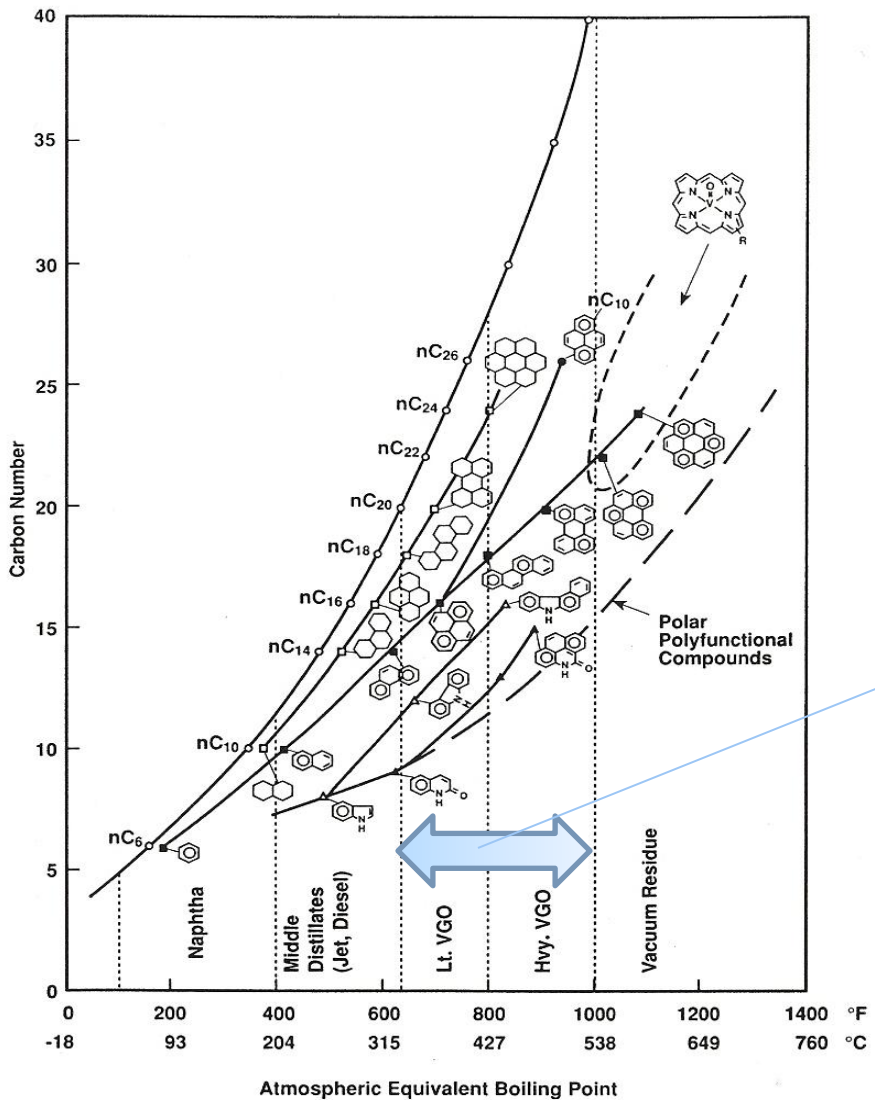
Slurry undergoes chemical reactions

1. **Heat and pressure:** the slurry is exposed to heat and pressure, causing separation of materials
2. **Chemicals:** solvents are added to complete separation process

Extraction process creates refinable crude oil



## The Boduszynski Plot: C# vs. AEBP



Algae Oil Feed

# Sapphire's oil is refinable into drop-in fuels using conventional refining technology, requiring no change in infrastructure

## Jet fuel

Two test flights: Continental Airlines 737-800 (Houston) and Japan Airlines 747-300 (Tokyo)



## Gasoline and diesel

10-day cross-country tour of plug-in Toyota Prius



# Policy Priorities for the Algae Industry

- The Renewable Fuels Standards (RFS)
  - Algae is a qualifying biomass, with an established pathway, complete part 79 - 80
  - Algae still requires parity in the RFS and the advanced biofuels industry as a whole must work together to support the RFS
- Tax parity for algae with all other biofuel feedstocks
  - In August 2012, the **Senate Finance Committee** passed a bipartisan tax extenders bill that gives algae-based fuels AND green crude parity with cellulosic biofuels
- Renewable fuels should be given the same incentives as the Oil and Gas industry
- Farm Bill
  - The USDA's Farm Bill funds research on developing renewable biomass crops to supplant the RFS requirements through BCAP and Loan Guarantees
  - Senate has passed a 5-year Farm Bill which includes an Energy Title with mandatory funding
- DOD Initiatives
  - February 2010—Quadrennial Defense Review Report identifies climate change and access to reliable supplies of energy as threats to national security
  - The DoD has set ambitious goals to utilize biofuels to increase national security, it is the responsibility of our nation and our government to ensure that the DoD has the tools to deploy national security initiatives