BIOMASS 2013:

HOW THE ADVANCED BIOINDUSTRY IS RESHAPING AMERICAN ENERGY

DEMONSTRATION & DEPLOYMENT SUCCESSES
SAPPHIRE INTEGRATED ALGAL BIOREFINERY (IABR)

August 1, 2013

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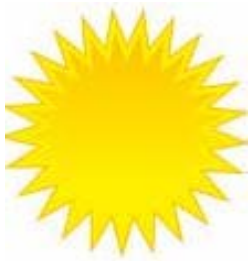
Sapphire Energy, Inc.

Sapphire produces drop-in crude oil from algae, sunlight, and CO_2 – in a scalable and sustainable process

Plentiful inputs



Scalable, open pond facilities

Green crude

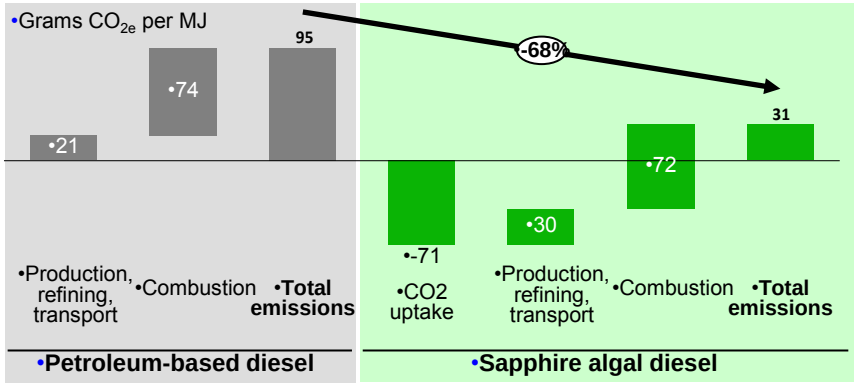
Fossil crude came from algae and other plants living millions of years ago; Sapphire radically accelerates a natural phenomenon

Non-potable water • Non-arable land • Enhanced algae • Proprietary process

Algae is a superior renewable feedstock

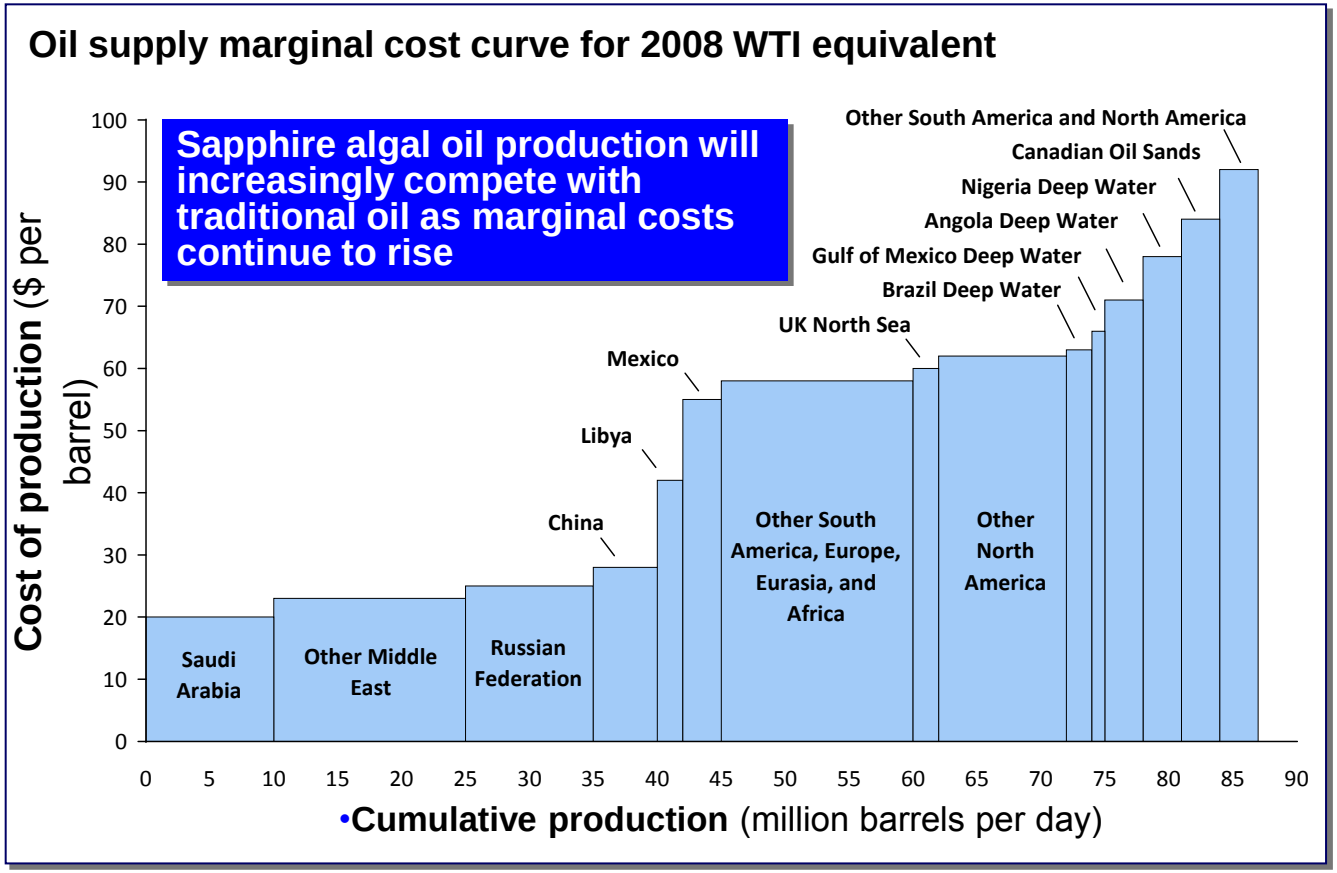
Superior attributes of algae

- **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_2
- **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



Source: Cambridge Energy Research Associates

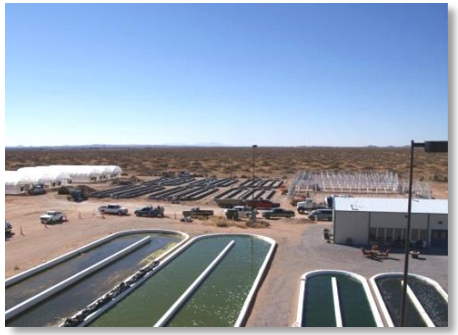
Introducing Sapphire Energy: Building world-scale, high-margin production of crude oil

Sapphire creates crude oil from CO_2 and sunlight

- ***Enormous market opportunity***
  Addressable markets are **over $3 trillion** and span multiple product segments (oil, chemicals, agriculture)
- ***Strong market pull***
  Sapphire's process is economically competitive, low carbon, and sustainable
- ***Sapphire's process commands the full oil production margin and is low cost***
  Sapphire has demonstrated a fully-integrated, high-yield, scalable, **outdoor, open pond algae oil production system**
- ***Sapphire is an attractive investment with strong and sophisticated backers***
  Sapphire has **raised over $340 million** from private investors and non-dilutive U.S. Government funding

Sapphire Energy™

•**San Diego R&D facility**



•**Las Cruces pilot facility**

•**Commercial demonstration facility**

Sapphire's investors are among the most sophisticated and prestigious in the world

Representative Investors and Partners

wellcome trust

Cascade Investment, LLC

THE LINDE GROUP

TESORO

MONSANTO

Venrock

ARCH Venture Partners

U.S. Government Partners

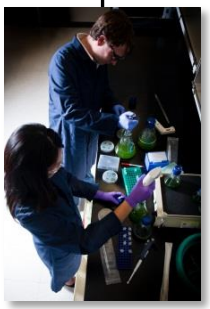
DEPARTMENT OF ENERGY • UNITED STATES OF AMERICA

USDA

From the very beginning Sapphire's focus has been to create a drop-in replacement for crude oil from algae

Laboratory/ Proof of Concept

2005-Ongoing



Pilot proof of concept/ improvements

2009-Ongoing

Commercial Demonstration

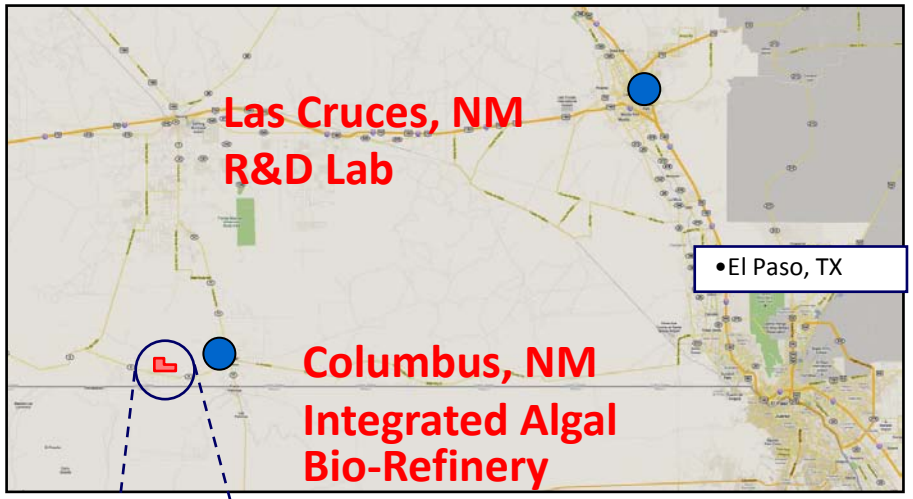
2012-2015

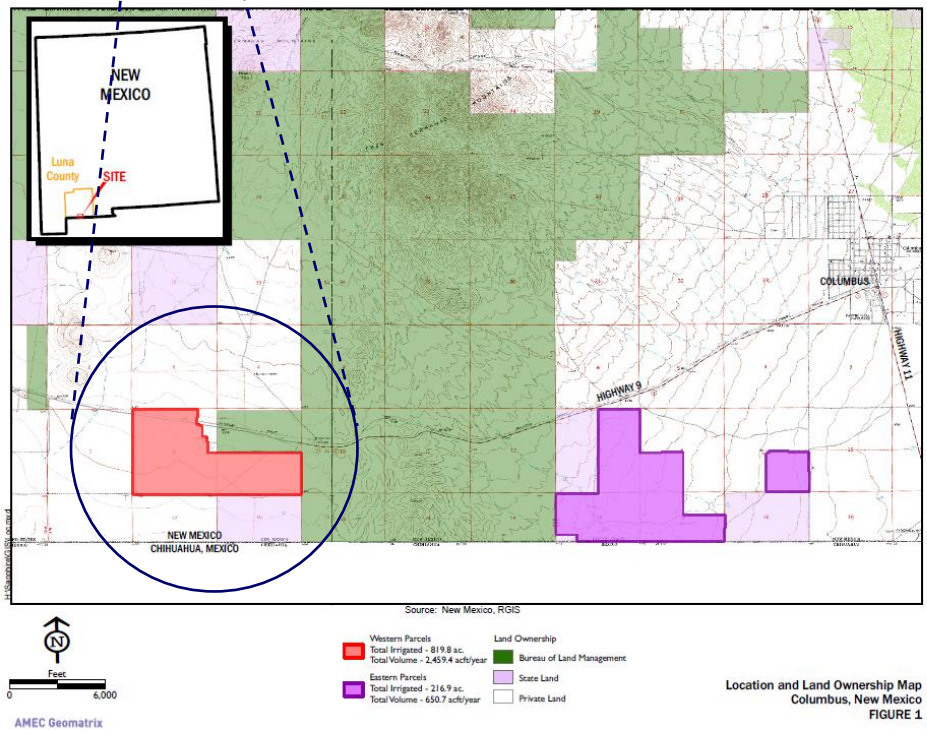
Commercial Launch

2016-2018

Sapphire Energy™

LOCATIONS



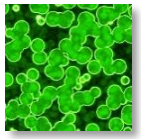
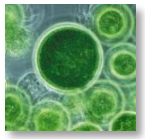
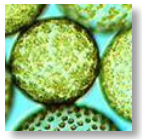


- **At Completion – Proof of Commercial Demonstration for Large Scale Production of Transportation Fuels from Algae Feedstock**
- **Integrated Process:**
  - Biomass Growth
  - Biomass Harvesting
  - Oil Extraction
  - Water and Nutrient Recycle
  - Energy use Optimization
  - Waste Stream Minimization
- **$135 MM total project costs**

Sapphire has developed the most advanced large-scale algal oil system in the world

Algae facility in Columbus, NM

Strain creation

Cultivation

Harvesting

Extraction & processing

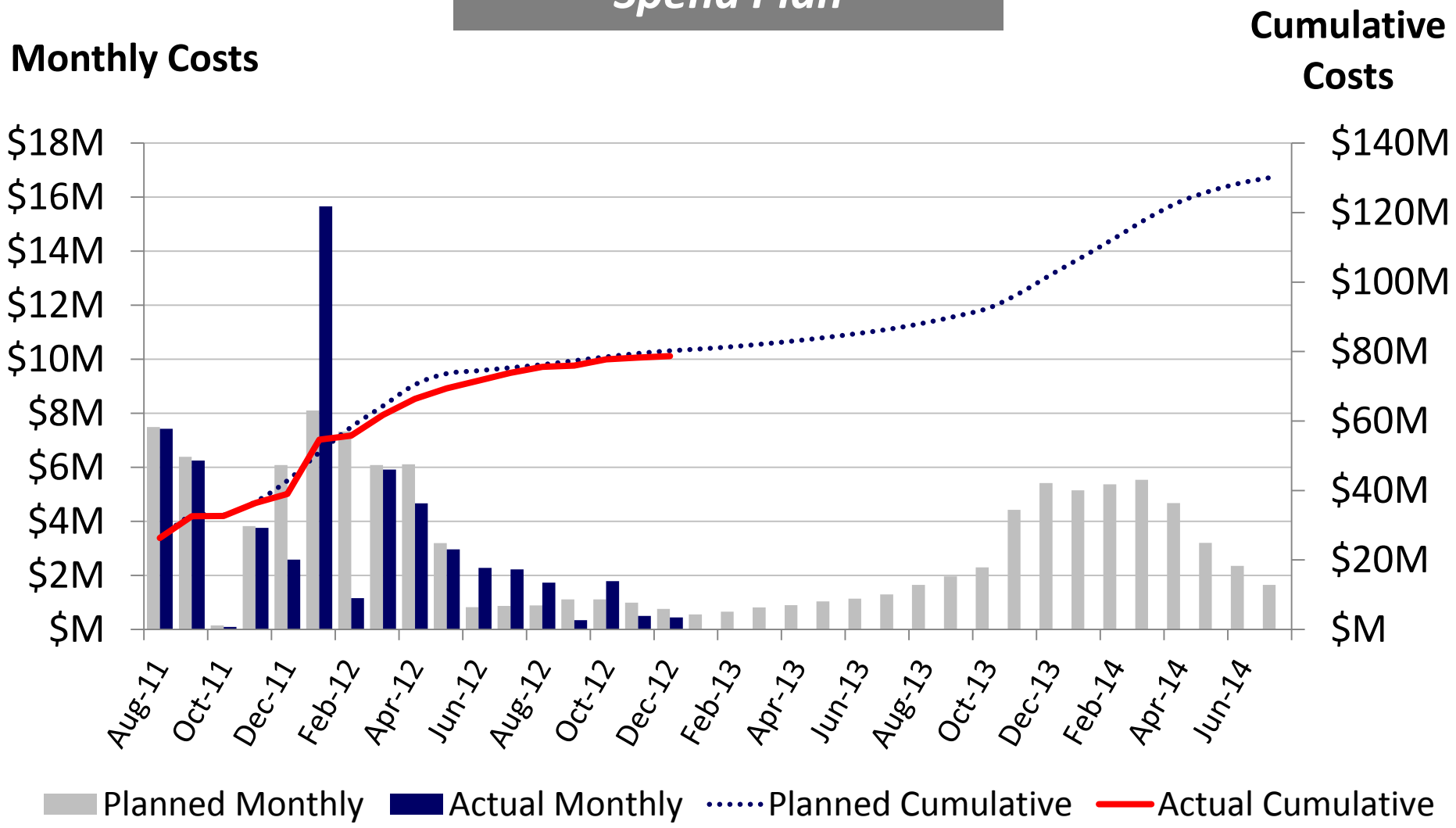
Refining (final products)*

Advanced algae strain development

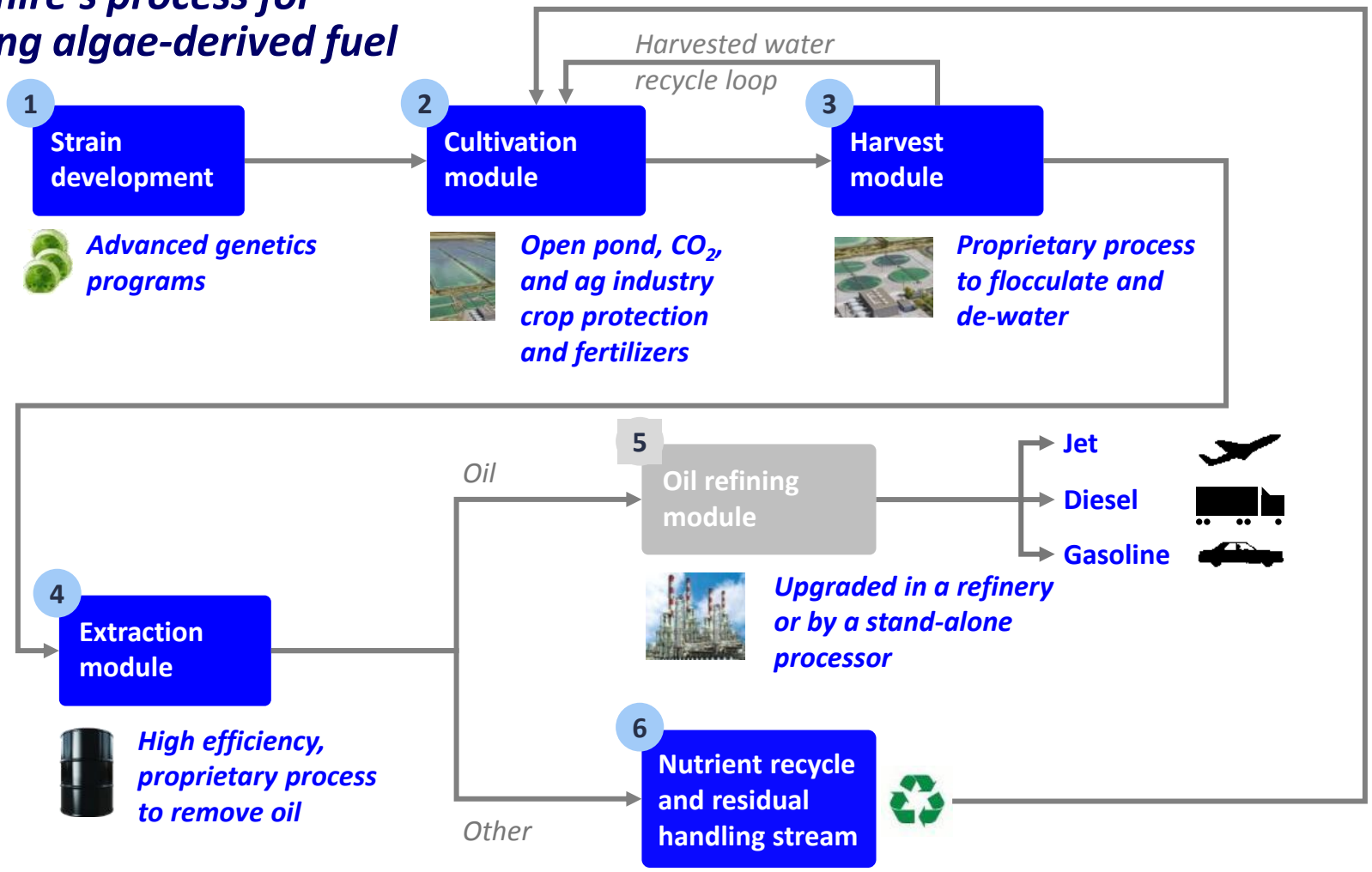
Algae-derived fuel process units

* Upgraded in a refinery or by a stand-alone processor;
Sapphire's oil quality enables processing in today's refineries with no modifications

Spend Plan


Monthly Costs
Cumulative Costs
$18M
$16M
$14M
$12M
$10M
$8M
$6M
$4M
$2M
$M
$140M
$120M
$100M
$80M
$60M
$40M
$20M
$M
Aug-11
Oct-11
Dec-11
Feb-12
Apr-12
Jun-12
Aug-12
Oct-12
Dec-12
Feb-13
Apr-13
Jun-13
Aug-13
Oct-13
Dec-13
Feb-14
Apr-14
Jun-14
Planned Monthly
Actual Monthly
Planned Cumulative
Actual Cumulative

Sapphire's process for making algae-derived fuel



Sapphire Energy is providing barrels of oil to be refined for market use

TESORO

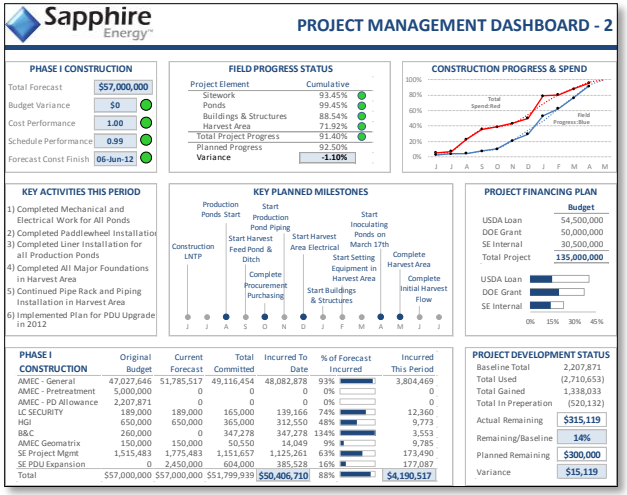
- Tesoro recently signed an agreement to purchase crude oil from Sapphire Energy's Green Crude Farm in Columbus, New Mexico
- This begins the first step of a commercial relationship to process Green Crude oil from Sapphire's future commercial facilities

- In initial testing by Sapphire Energy, Green Crude oil was refined into **on-spec ASTM 975 diesel fuel**, proving its compatibility with the existing network of pipelines, refineries and transport systems
- Sapphire Energy will grow production significantly to further expand its commercial demonstration and begin the transition towards commercial-scale production

Rationale & Drivers for Prioritization of Project Objectives

- Purposeful and targeted technology and biology program development
- Data and piloting based
- Stage Gate decision making / spending approval
- Maximize Project Success Criteria
  - Integrated process
  - Commercial demonstration scales
  - Commercial demonstration economies
  - Budget control
  - Schedule constraints
  - Stakeholder interests

- Establish dedicated PMO
- Utilize personnel with a proven track record of developing and executing complex projects
- On-site Sapphire personnel to provide owner oversight during construction
- Baseline focused project execution
- Utilize industry standard tools and management practices
    - Stage gate process
    - Primavera CPM schedules
    - Establish baseline metrics and measure on regular basis
    - Robust project reporting systems
- Establish open reporting to all stakeholders
- Hold regular status reviews with stakeholders
- Early identification of project deviations
    - Develop mitigation plans
    - Identify variances



Site details: the project is located on land that was previously used for farming, but no longer is fertile

The site prior to Sapphire's ownership

- **Land was used for farming until 1973**
- **Land was abandoned for farming use because the underlying water source became to saline**
- **Few other productive uses until Sapphire started developing the current project**

Construction: the first phase of the project was constructed over the 2011/2012 timeframe and has proceeded on-schedule and on-budget

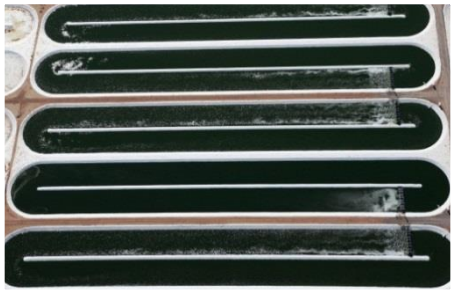
December 2011

May 2012


Startup and commissioning: construction is completed and the facility has been in continuous integrated operation since June 2012
¼ Mile
1 Mile


From the air (looking east to west) – late November 2012

The phase one shakedown for the Green Crude Farm is designed to demonstrate the viability of all unit processes and operations



Cultivation

Open pond, CO_2, and ag industry fertilizers and crop protection methods

Harvest

Proprietary process to flocculate and de-water
Dissolved Air Flotation unit allows us to skim algae from the water
Algae slurry is transported to the extraction unit

Conversion / Extraction

Sapphire uses a proprietary, innovative, solvent-based system to process oil and nutrients Slurry undergoes chemical reactions with heat, pressure and solvents to create refinable crude oil

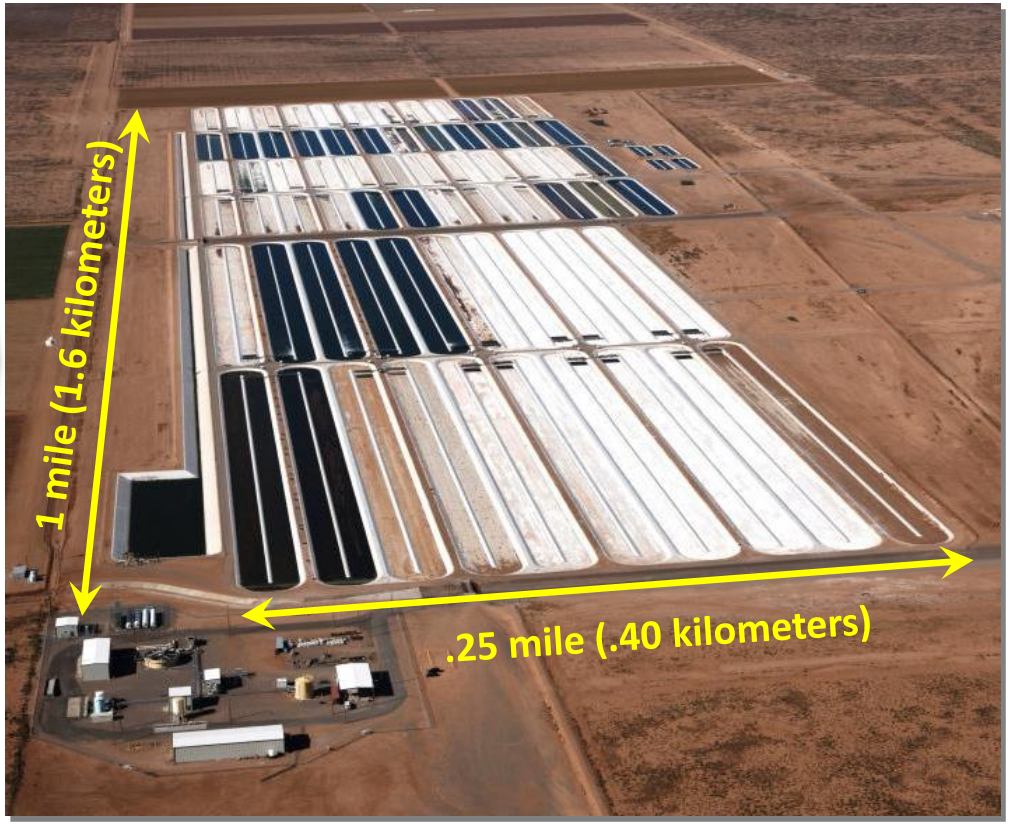
Large-scale production of photosynthetic algae

Pilot technology facility

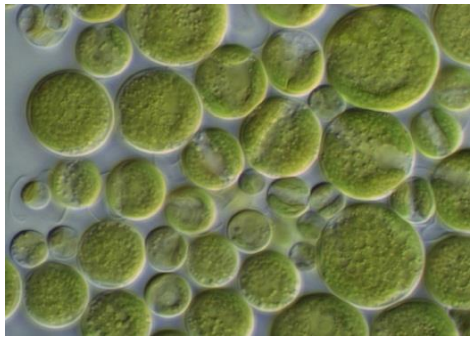
- **22-acre pilot facility** operated since 2009
- Over **180,000 hours** of large pond cultivation piloting

Commercial demonstration facility

- Sapphire is operating the **world's first integrated algal-oil production facility**
- Operations began in Q3 2012



Cultivation: Sapphire grows algae in a proven, scalable, growing system, while continually reducing cost



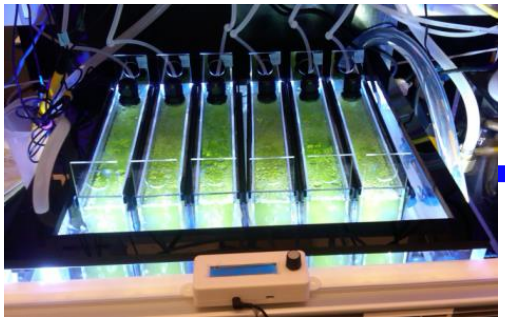
Algae grow rapidly and continuously, all year

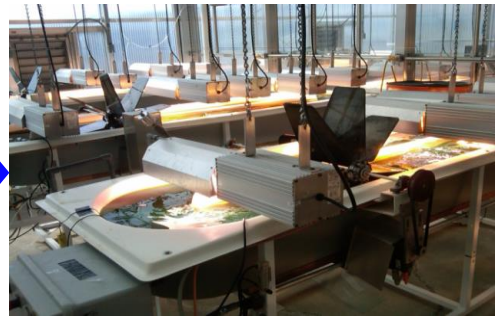
- Ponds are harvested daily and some of the biomass is removed for processing
- The remaining algae quickly replicate and replace the harvested portion
- The result is a consistent biomass density, set for optimal growth

Sapphire has a fully integrated R&D asset pipeline, enabling creation and testing of strains from the laboratory to the field

Laboratory (SD)

- Screening
- Columns
- Pond simulators
- Greenhouse mini-ponds





Pilot facility (NM)

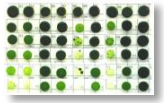
- Outdoor mini-ponds
- Large Ponds
- Harvest
- Extraction

Comm. Demo. (NM)

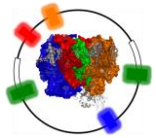
- Inoculation Ponds
- 1.1 Acre & 2.2 Acre ponds
- Harvest Channel & Pond
- Large Scale Harvest
- Water Return Pond

Sapphire has advanced biotech and oil production systems

Molecular and biochemical innovation, enhancement, control, and oil production



High throughput screening and selection
(not previously demonstrated with algae)



Novel genetic enhancements and manipulations
(not previously possible with algae)

Advanced, industrial-class crop evaluation systems

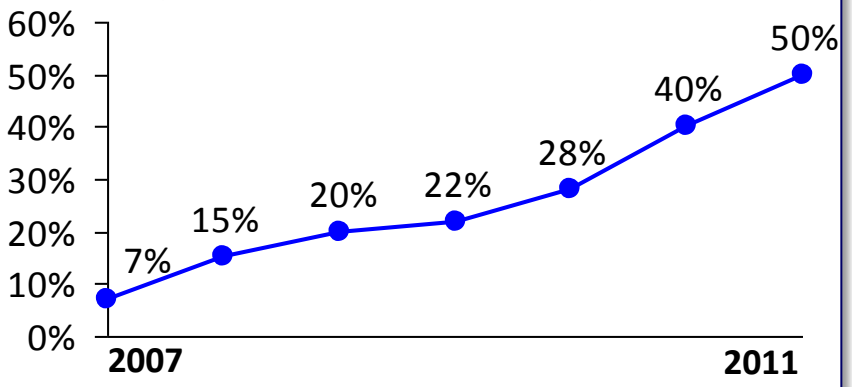
Breakthrough, novel chemical engineering and oil production systems

Sapphire's technology improves strain robustness

Healthy Sapphire improved strain **Unhealthy base strain**

Sapphire has steadily increased oil extraction yield and decreased cost

Percentage of biomass extracted as hydrocarbon



WET EXTRACTION—
BREAKTHROUGHS IN THE FIELD

Harvesting: algae and water are separated to prepare algae for extraction

Sapphire uses a Dissolved Air Flotation (DAF) system to concentrate algae

Solution enters the DAF in dilute concentration

DAF technology adapted for algae

1. **Cluster**: chemicals are applied which make the algae stick together
2. **Float**: air bubbles float algae to the surface
3. **Skim**: floating algae harvested with a skimmer

After the DAF, the algae is concentrated

Harvesting: algae and water are separated to prepare algae for extraction

Dissolved Air Flotation (DAF)

Dilute Algae

•Concentrated Biomass

Extraction: the harvested algae slurry 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

Extraction breakthrough: Sapphire has substantially increased the amount of oil which can be recovered from biomass

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

Strain	Extracted oil yield (% ash free dry weight)	
	Prior Methods	Sapphire Process v2
Strain A	15%	50%
Strain B	15%	43%
Strain C	10%	48%
Strain D	10%	38%
Strain E	5%	38%
Strain F	5%	36%
Strain G	5%	41%
Strain H	5%	39%

Advantages:

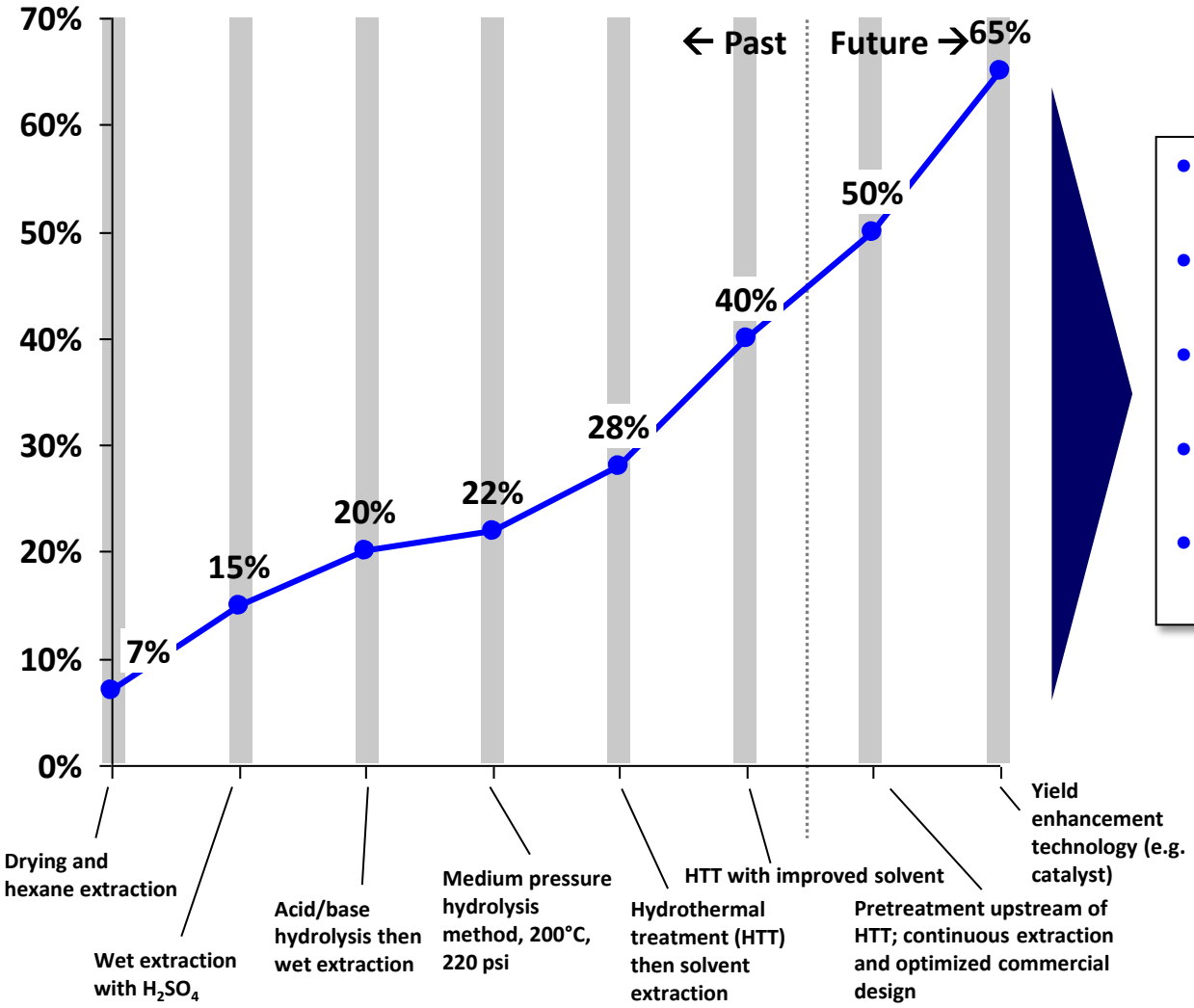
- **Algae can be processed wet**
- **High yield boost**
- **Enables broad range of algae strains**


Extraction: Renewable Green Crude oil leaves the extractor
Sapphire Energy™

COMPATIBLE CRUDE OIL—*BREAKTHROUGHS IN THE FIELD*

Extraction R&D projects have substantially increased the amount of oil which can be recovered from biomass

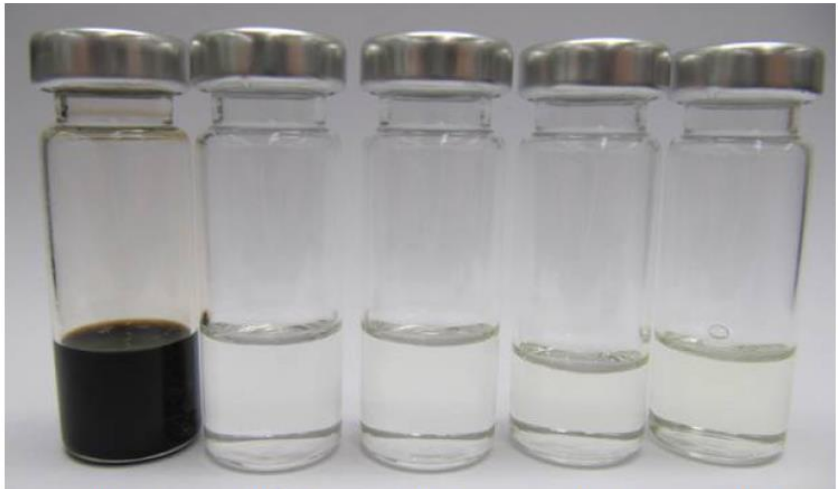
Extractable oil fraction
Mass of oil per mass of algae



- Past and future yield benefits are absent biological improvement
- Patent issued for conversion and extraction process on June 5, 2012
- Operating demonstration scale HTT since October 2011
- Plan to convert demonstration scale HTT and extraction to improved solvent in 2014
- Lab, pilot and demonstration scale facilities for R&D

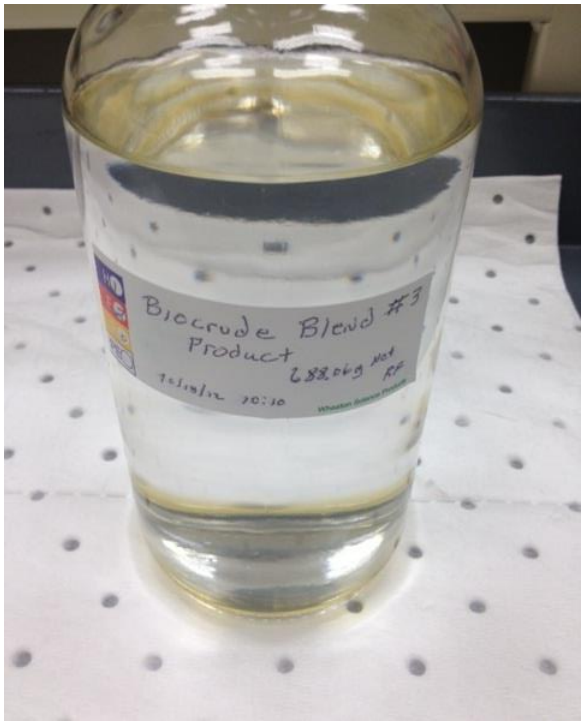
Algae bio-crude has been successfully upgraded at typical refinery hydrotreating conditions

10% Sapphire bio-crude balance solvent and inerts



d = g/ml	0.7932	0.7795	0.7798	0.7793	0.7803
S = ppm	466	7*	12.1*	12.9*	12.6*
N = ppm	3537	3	13.7	23.3	48.4
TOS = hour	0	36	60	108	192

10% Sapphire bio-crude with petroleum feedstock (6 day test run)



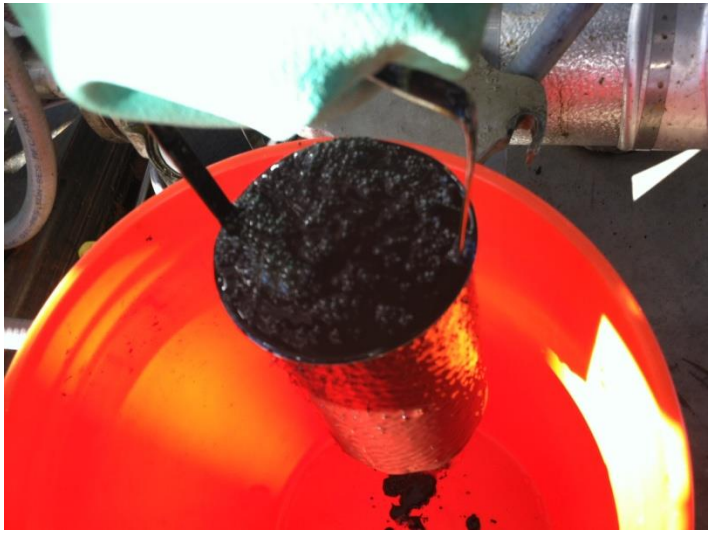
Diesel product meets all requirements of ASTM D975

Challenges and Success

Corn Husks

Tumbleweeds

PDU Filter



Black Oil

Sapphire's intellectual property program has produced a robust portfolio

Extensive portfolio

- **Over 303 active patent cases***
- ~50 patent families
- Average of 25 filings annually
- Filings and grants are worldwide

Freedom to operate and barrier to entry

Includes patents on all key platform technologies

- Molecular biology
- Cultivation / harvesting
- Extraction
- Upgrading
- Analytics

Claims limit competitors' freedom to operate

- Sequences
- Organisms
- Oils and products

* As of September 2012

Relevance	The IABR is a key step in the development of commercial scale drop-in crude from algae, sunlight and CO_2
Approach	Purposeful and targeted technology development that is data driven and maximized for project success
Technical Accomplishments	Large scale outdoor production of drop-in crude to be refined for market use
Success Factors and Challenges	Need to continue with project balance to deliver final goals and maintain momentum and policy support
Future Work	Build out and deployment of Next Generation Technologies

Sapphire is currently producing barrels of Green Crude Oil

Sapphire Energy™