Sapphire Energy, Inc.

Sapphire Energy

New Mexico: Leading the World in Algae-based Fuel Production

Sapphire Energy

Company snapshot

Founded in May 2007

Investors include Venrock Associates, ARCH Venture Partners, Wellcome Trust, Cascade Investment, and Monsanto

Partnerships with Monsanto (seed biology) and Linde (CO_2 technology)

155 employees across three facilities

- Southern California: research lab, engineering office, and headquarters
- Las Cruces, New Mexico: test and development site
- Columbus, New Mexico: *commercial demonstration facility* of an integrated algal biorefinery; USD 105 million grant and loan package from the USDA and DOE

Vertically integrated, addressing every step from biology to oil extraction

- Strain development: advanced breeding and genetics program
- Cultivation: open pond, photosynthetic growth systems
- Harvest: proprietary process to flocculate and de-water
- Extraction: high efficiency, proprietary process to remove oil

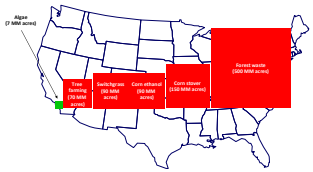
Algal oil, or "Green Crude," can be processed into gasoline, diesel, and jet fuel by existing petroleum refineries

San Diego R&D facility

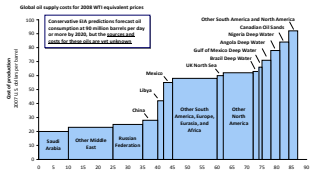
Las Cruces test facility

Commercial demonstration facility

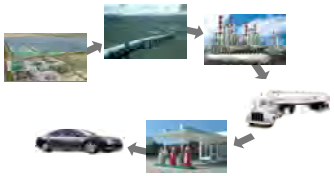
Sapphire's "Green Crude" from algae is a replacement for petroleum, satisfying all five first principles



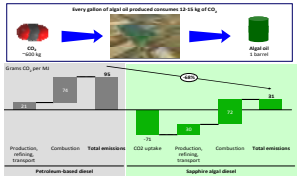
Scalable to millions of barrels per day



Cost competitive with marginal crude oil production



Completely fungible with existing petroleum infrastructure and fleet



Favorable life cycle with respect to CO_2

Does not compete with agricultural products, land, or water

Significant progress in algal fuel technology has been made at Sapphire Energy

As of today, investment in Sapphire Energy by Government and private investors exceeds $200 Million

2007: Sapphire Energy is founded with ARCH Venture Partners

Sapphire Energy™ ARCH Venture Partners

2008: Sapphire Energy investment reaches $100MM as Venrock, the Wellcome Trust, and Cascade join investment syndicate

Venrock

wellcome trust

Cascade Investment, LLC

2009: Sapphire Energy algae fuel demonstrated in airliner & automobile

Continental test flight

Cross-country tour

2009: Sapphire Energy wins $104.5MM in Government grants and loan guarantees, becoming the only algae firm to win a *demonstration-scale* award

USDA

2011: Development of an Integrated Algal Biorefinery

2011: Strategic partnerships with the Monsanto Company and the Linde Group

MONSANTO THE LINDE GROUP

Time

Aquatic crops are the most efficient pathway to use photosynthesis to produce crude replacements

Production of a crude replacement requires two things:

- **A source of carbon:** making a hydrocarbon backbone *de novo* requires assembly of carbon atoms
- **A source of energy:** joining carbon atoms requires significant energy (which is stored in the hydrocarbons and returned when they are burned)

Pathway 1: Use sugar for BOTH the carbon source AND the energy source

Both energy & carbon source
Sugar (e.g., sugar cane)

+

Fermenters
Organisms refine into oil

Pathway 2: Use CO2 for the carbon source and sunlight for the energy source

Energy source
Sunlight

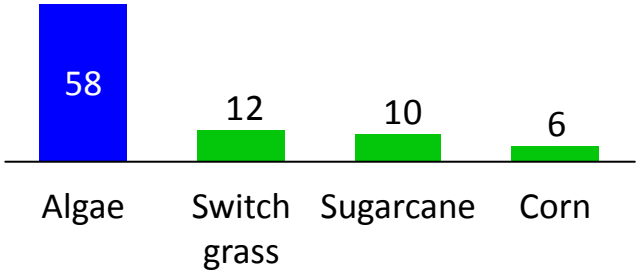
$h\nu$

+

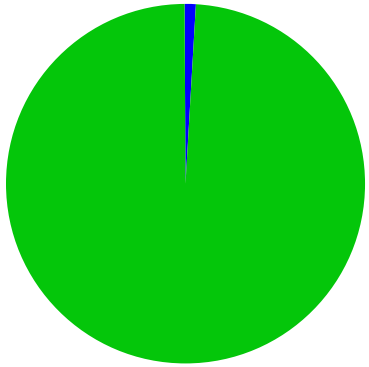
Carbon source
Carbon dioxide

Aquatic plants
Terrestrial plants

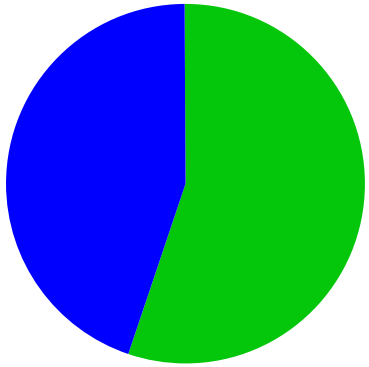
Growth efficiency
MT/acre-year



Plant mass **on Earth**



Photosynthesis **on Earth**



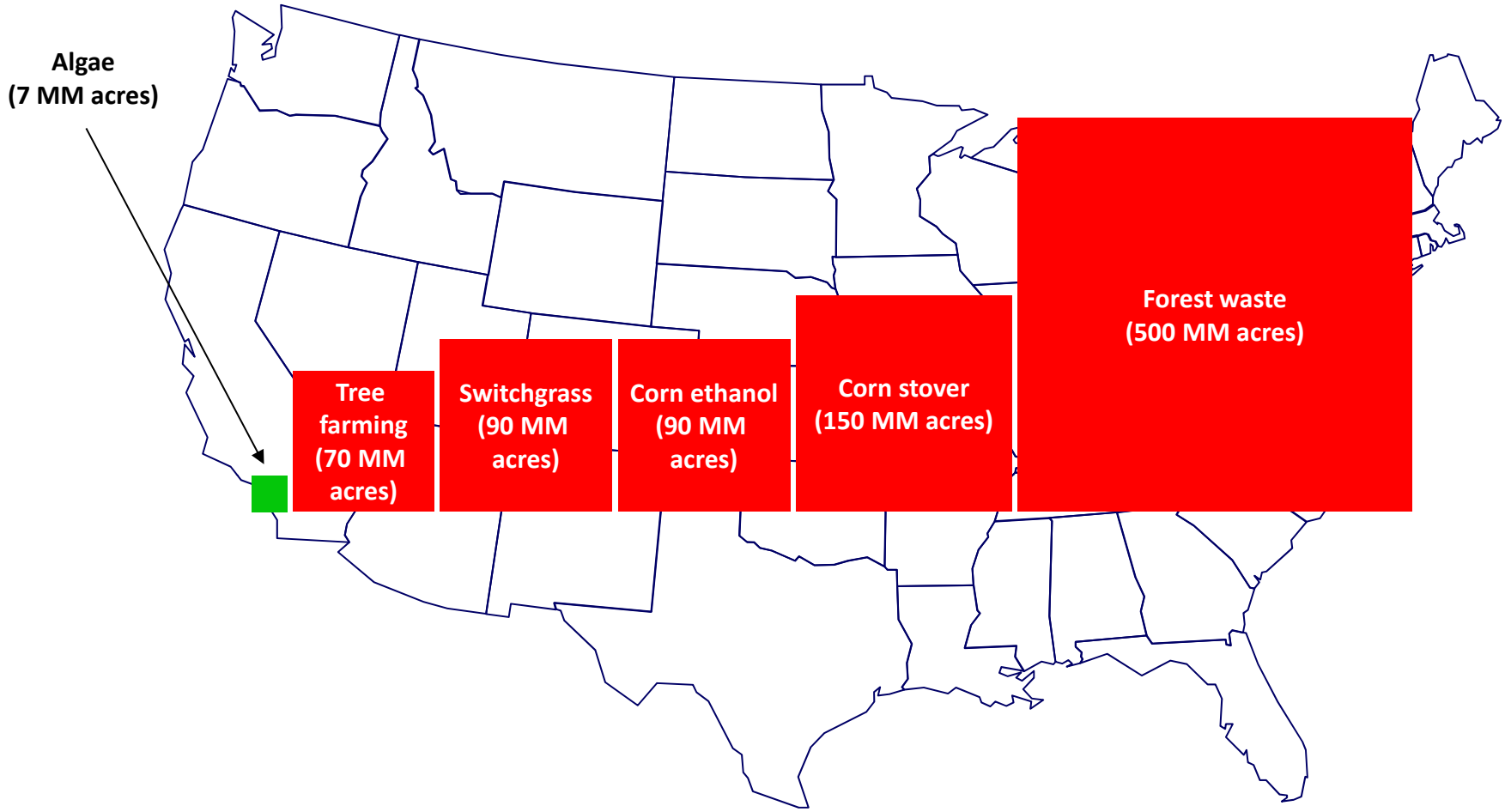
New Mexico is an optimal location for algae-derived fuel production

Conditions found in New Mexico

- Ideal growing conditions for algae cultivation
  - Solar intensity
  - Temperature range
- Access to North America's largest salt-water aquifers
- Superior land characteristics
  - Non-agricultural
  - Available, contiguous, and level

The land required for algae to displace 15% of US transportation fuel usage is a fraction of that of other feedstocks

SCALABLE



Note: Calculated on a Btu basis. Assumes all algae is used to produced diesel and all cellulosic processes produce ethanol.
Sources: CA Air Resources Board, GREET model, 2009; Walters, Yang, "Corn stover removed without compromising soil quality", Department of Agronomy & Horticulture, University of Nebraska-Lincoln; Vinod Khosla

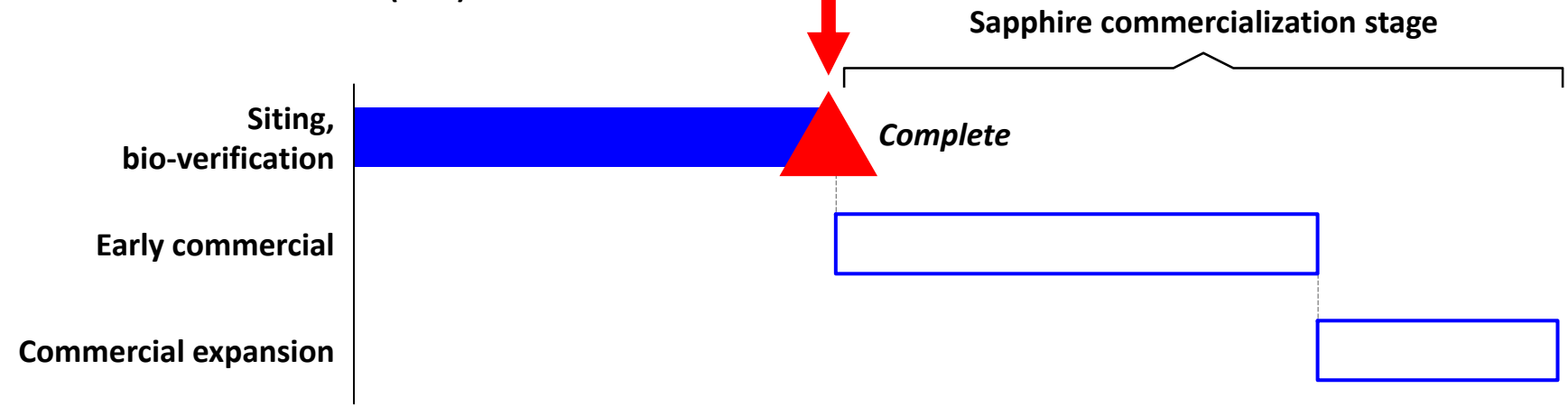
Sapphire has completed test, development and site verification in New Mexico, USA

Test & development site

Facilities & ponds

- Laboratory, offices, & processing
- Cultivation from column reactors to 1,000,000 liter raceway ponds
- Ponds and cultivation piloted for more than 80,000 hours
- More than 200 days with no significant contamination

Commercialization timeline (USA)

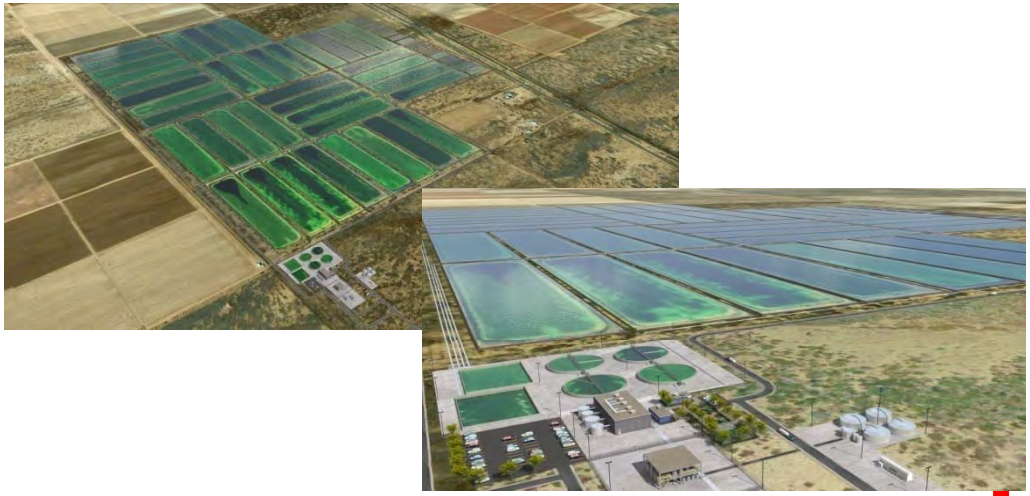


Economic Impact from Sapphire Energy on the city of Las Cruces

	2008	2009	2010	2011
Total economic output ($)	11,000,000	13,000,000	31,000,000	51,000,000
Total earnings ($)	3,000,000	4,000,000	9,000,000	15,000,000
Total value added ($)	6,000,000	7,000,000	17,000,000	28,000,000
Total employment (FTE)	77	96	223	373

The Commercial Demonstration Facility in New Mexico is fully financed and on-schedule

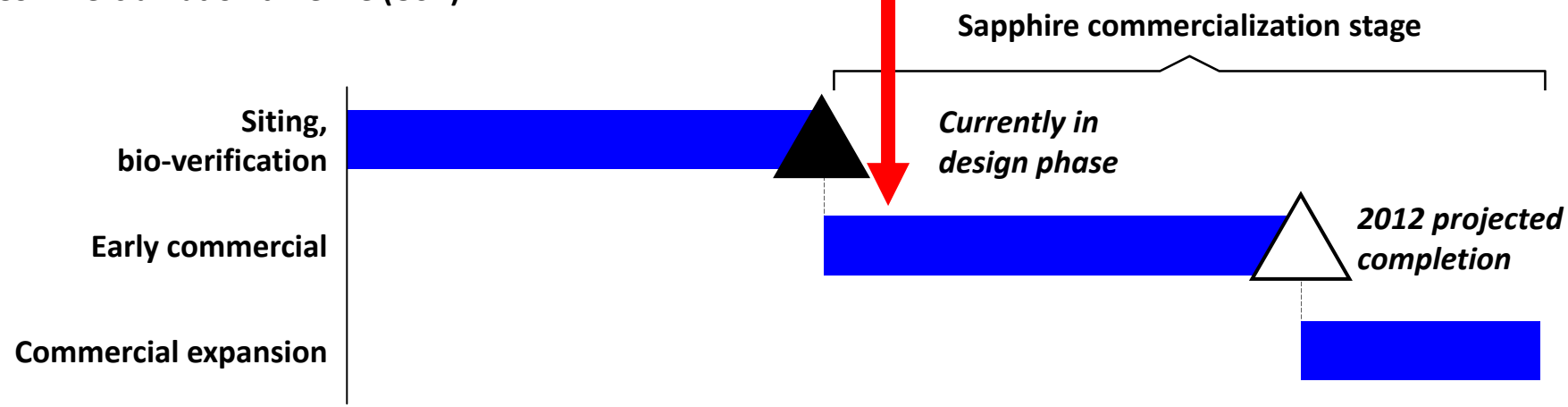
Fully integrated algal biorefinery (IABR)



Facilities & ponds

- Commercial demonstration
- Contains all unit processes of a commercial facility
- 300 cultivated acres of ponds
- 80 bbls per day
- Complete in 2012
- ~750 direct and indirect jobs created in rural New Mexico

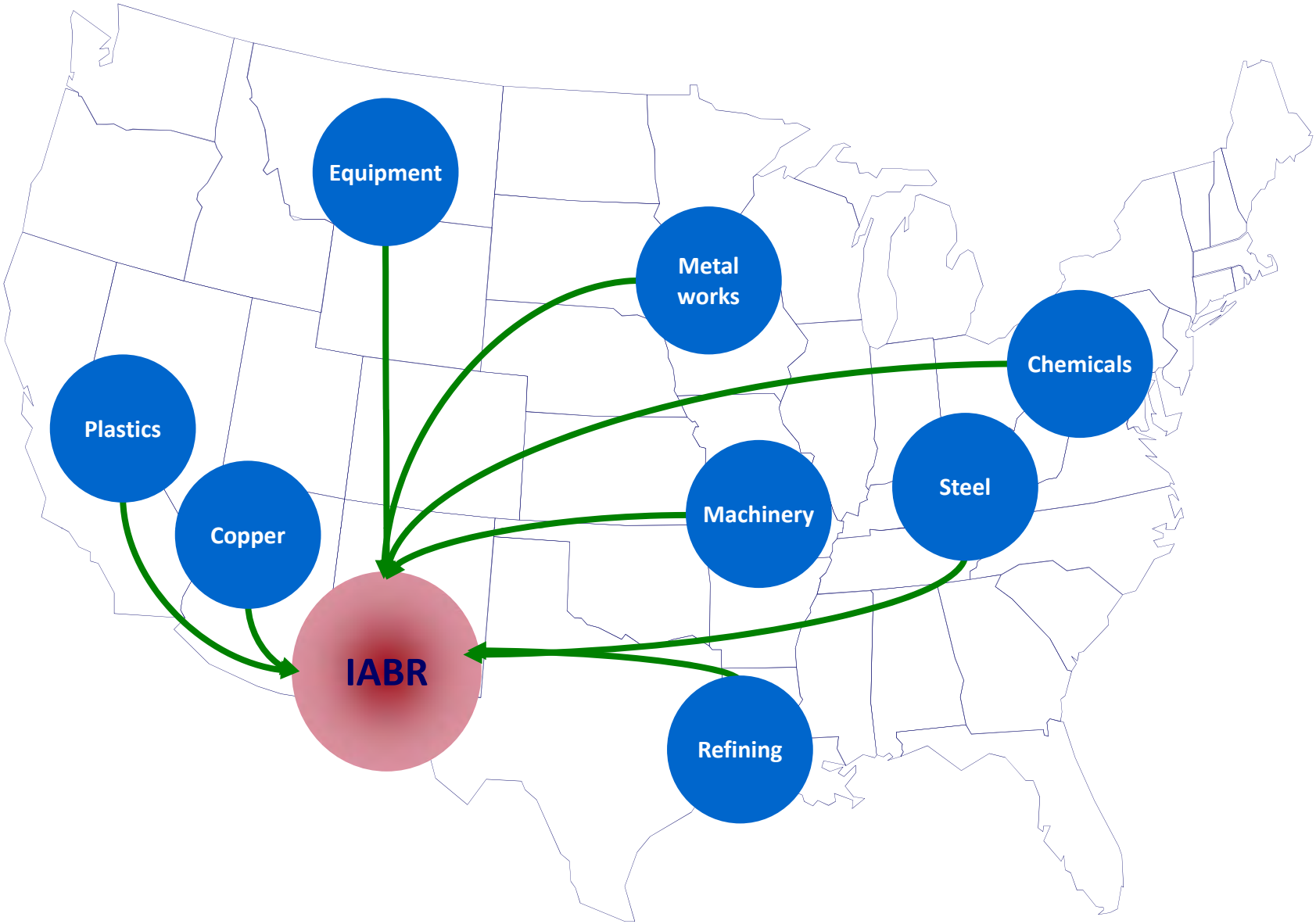
Commercialization timeline (USA)



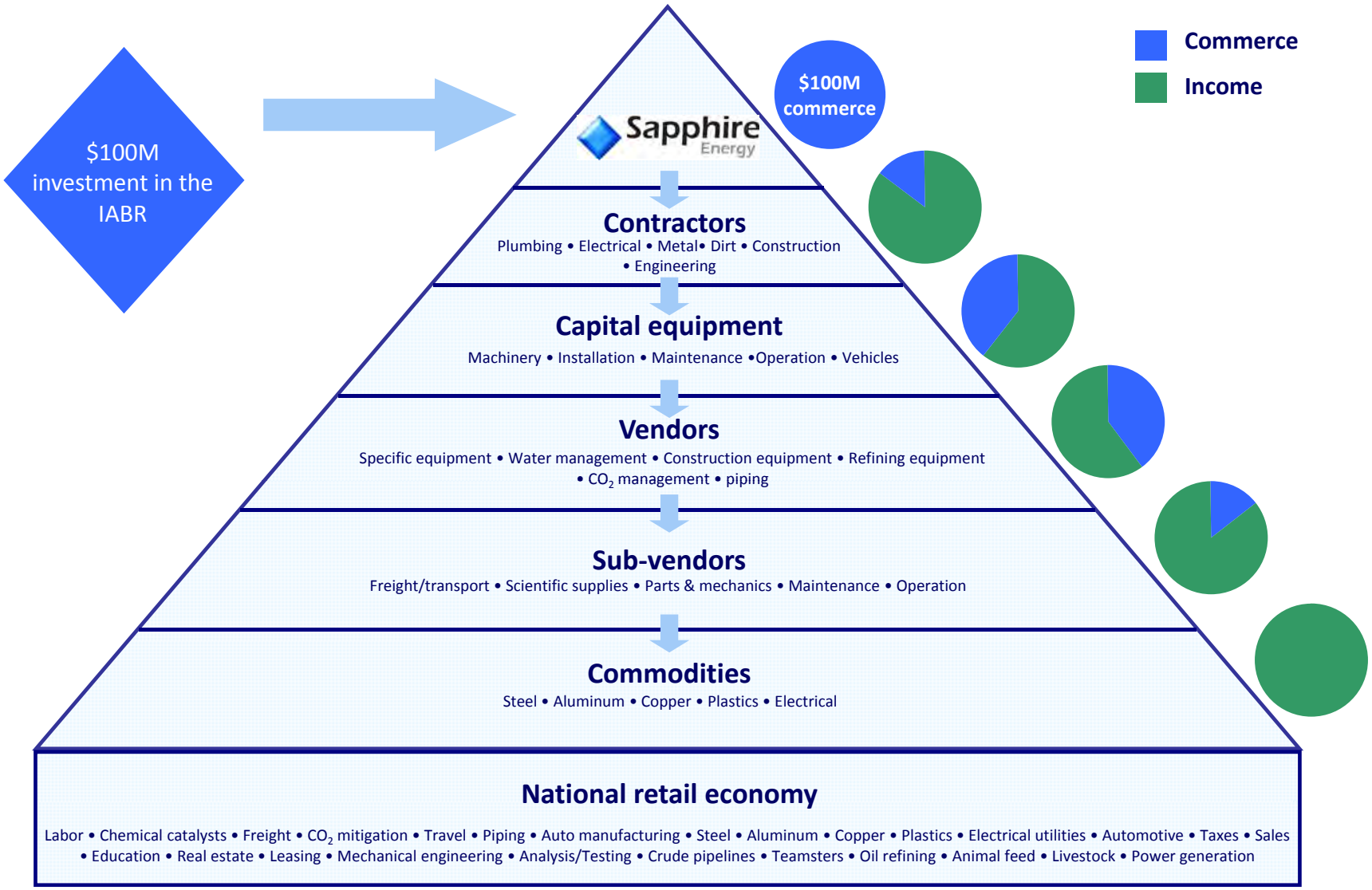
Three-phase IABR deployment goals

	Operations start	Project Elements	Goals	Oil yield/purpose
Phase I	Q1, 2012	End-to-end unit ops, optimize for stability	Summer Stability	Produce demonstration quantities for USN/AF
Phase II	Q2, 2013	Next generation pond design development	Validate trajectory to 50 tonnes/day	Validate trajectory to 2015 target, USN/AF renewable fuels initiative
Phase III	Q2, 2014	100% year round operations	≥ 50 tonnes/day CO_2	**2015 goal:** produce **1.3 million gallons** (83 barrels/day) **2016:** increase yields to produce **1.5 million gallons** (97 barrels/day) **Contribute** of USN/AF renewable fuel initiative

The IABR in New Mexico is the focal point of national economic activity



The IABR creates economic stimulus in multiple industries & generates jobs across wide skill sets



Job creation & investment in New Mexico will reach beyond Luna County

25% Soft costs

$20M Labor
65 person-years

- Design
- Accounting
- Legal
- Admin
- Oversight

$5M Consumables
100 vendors

- Computers
- Software
- Office materials
- Travel

65 jobs
100 vendors

60% Construction

$24M Labor
155 person-years

- Workers
- Architects
- Admin
- transportation
- operators

$24M Materials

- Steel
- Aluminum
- Plastics
- Transportation
- Operators

$12M Equipment
20 Vendors

- Machinery
- Construction
- Electronics

155 jobs
68 vendors

15% Post-project service

$10M Labor
40 person-years

- Maintenance
- Engineering
- Repair
- Transportation
- Installation

$5M Consumables
100 vendors

- Furniture
- Phones
- Utilities
- Travel

40 jobs
100 vendors

$10 Million | $20 Million | $30 Million | $40 Million | $50 Million | $60 Million

759 jobs*
268 vendors

* Using a discounted employment multiplier of 3, derived from the Bureau of Economic Analysis Regional Input-Output Modeling System

On August 16, the White House publicly announced the DPA program and released funding estimates and process timelines

The White House

Office of the Press Secretary

For Immediate Release August 16, 2011

President Obama Announces Major Initiative to Spur Biofuels Industry and Enhance America's Energy Security

USDA, Department of Energy and Navy Partner to Advance Biofuels to Fuel Military and Commercial Transportation, Displace Need for Foreign Oil, and Strengthen Rural America

WASHINGTON, Aug. 16, 2011 – President Obama today announced that the U.S. Departments of Agriculture, Energy and Navy will invest up to $510 million during the next three years in partnership with the private sector to produce advanced drop-in aviation and marine biofuels to power military and commercial transportation. The initiative responds to a directive from President Obama issued in March as part of his *Blueprint for A Secure Energy Future*, the Administration's framework for reducing dependence on foreign oil. The biofuels initiative is being steered by the White House Biofuels Interagency Work Group and Rural Council, both of which are enabling greater cross-agency collaboration to strengthen rural America.

MEMORANDUM OF UNDERSTANDING

BETWEEN

THE DEPARTMENT OF THE NAVY

AND

THE DEPARTMENT OF ENERGY

AND

THE DEPARTMENT OF AGRICULTURE

Funding and stakeholders

- $510 million from government sources, equally sourced from the **Navy, DOE, and USDA**
- Funding **must be matched** at least one-to-one; this will require Sapphire to secure debt and equity financing commitments from the market

Timeline

- The government aims to release an **RFP by the end of 2011**
- Government funding will be distributed over a **period of "the next three years"**