



Commercial Airplanes

Aviation Biofuel: Recent breakthroughs and long term prospects



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Environmental and Aviation Policy, Boeing Commercial Airplanes

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One Boeing, One Planet

“By improving the environmental performance of our products and operations, we ensure the vitality of Boeing as well as our customers, our industry and our communities worldwide. Together, we will continue to build a better planet.”



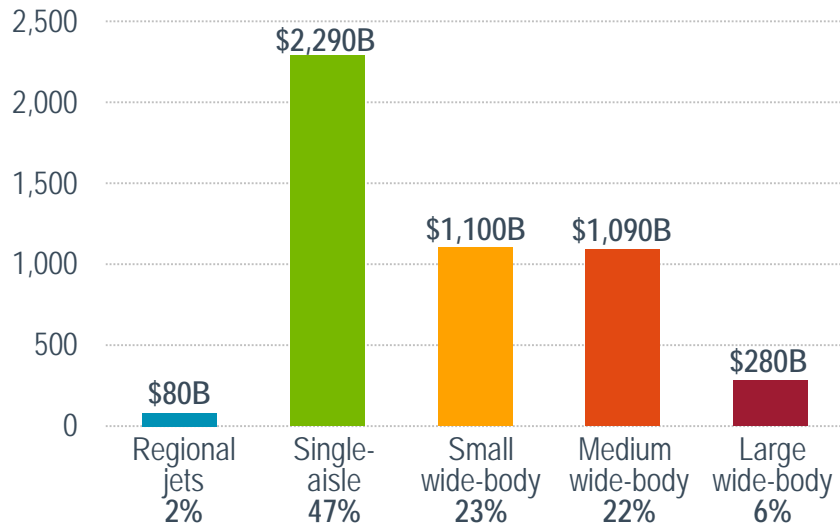
Jim McNerney
Chairman and CEO
The Boeing Company



By 2032, airlines will need more than 35,000 new airplanes valued at \$4.8 trillion

Market value: \$4.8T

2013 - 2032

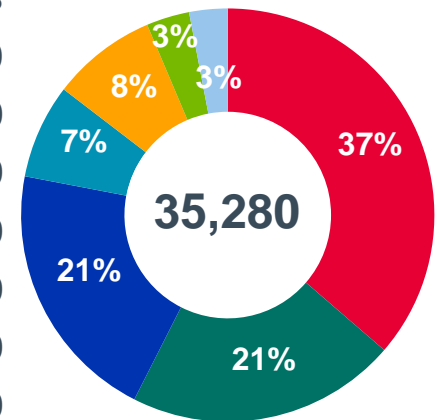


New airplane deliveries by region

2013-2032

Region Airplanes

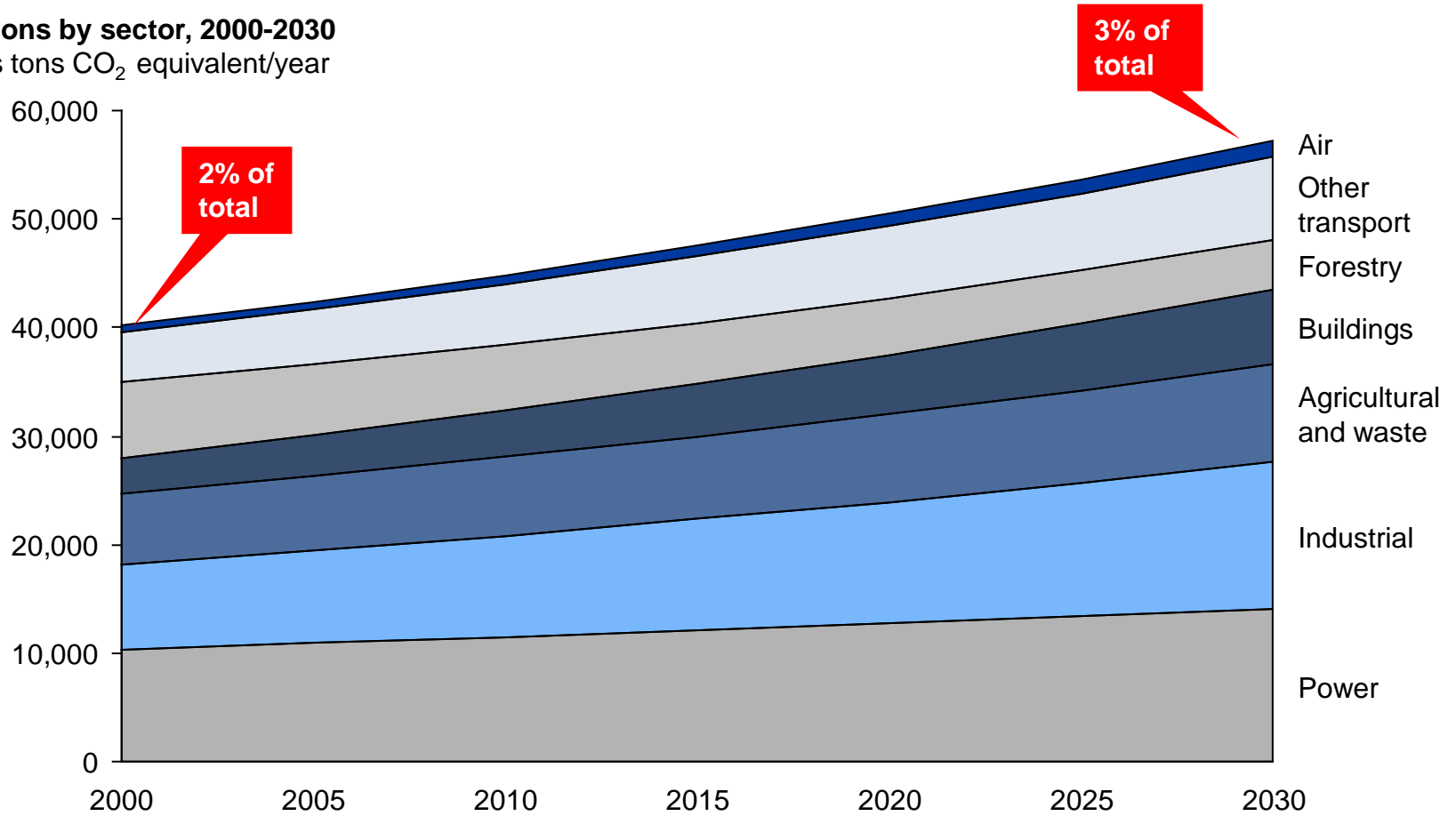
Asia Pacific	12,820
Europe	7,460
North America	7,250
Middle East	2,610
Latin America	2,900
C.I.S.	1,170
Africa	1,060
World Total	35,280



Global CO2 Emissions



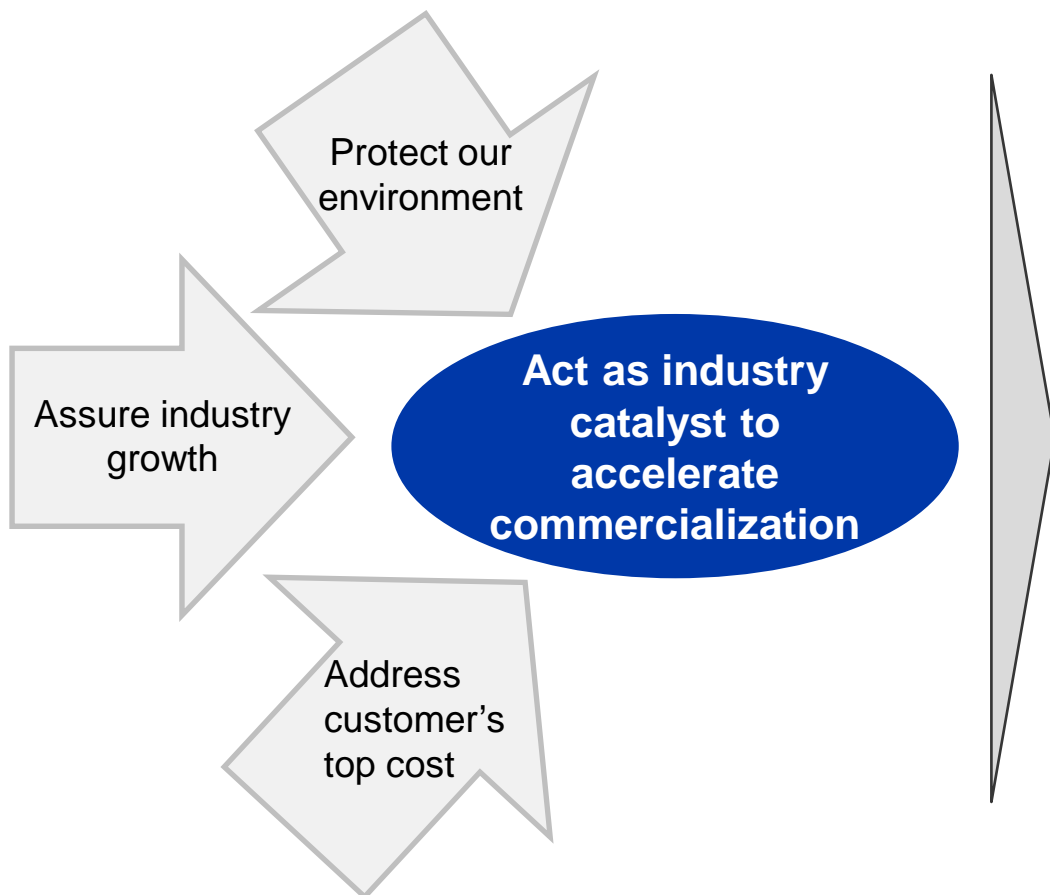
Emissions by sector, 2000-2030
Millions tons CO₂ equivalent/year



Source: IPCC

Boeing's Role and Actions

Boeing's Role

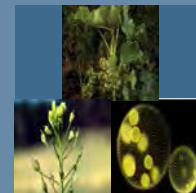


Core activities

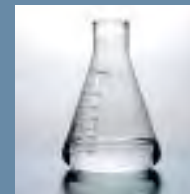
Support and Advocacy



Feedstock and Pathway R&D

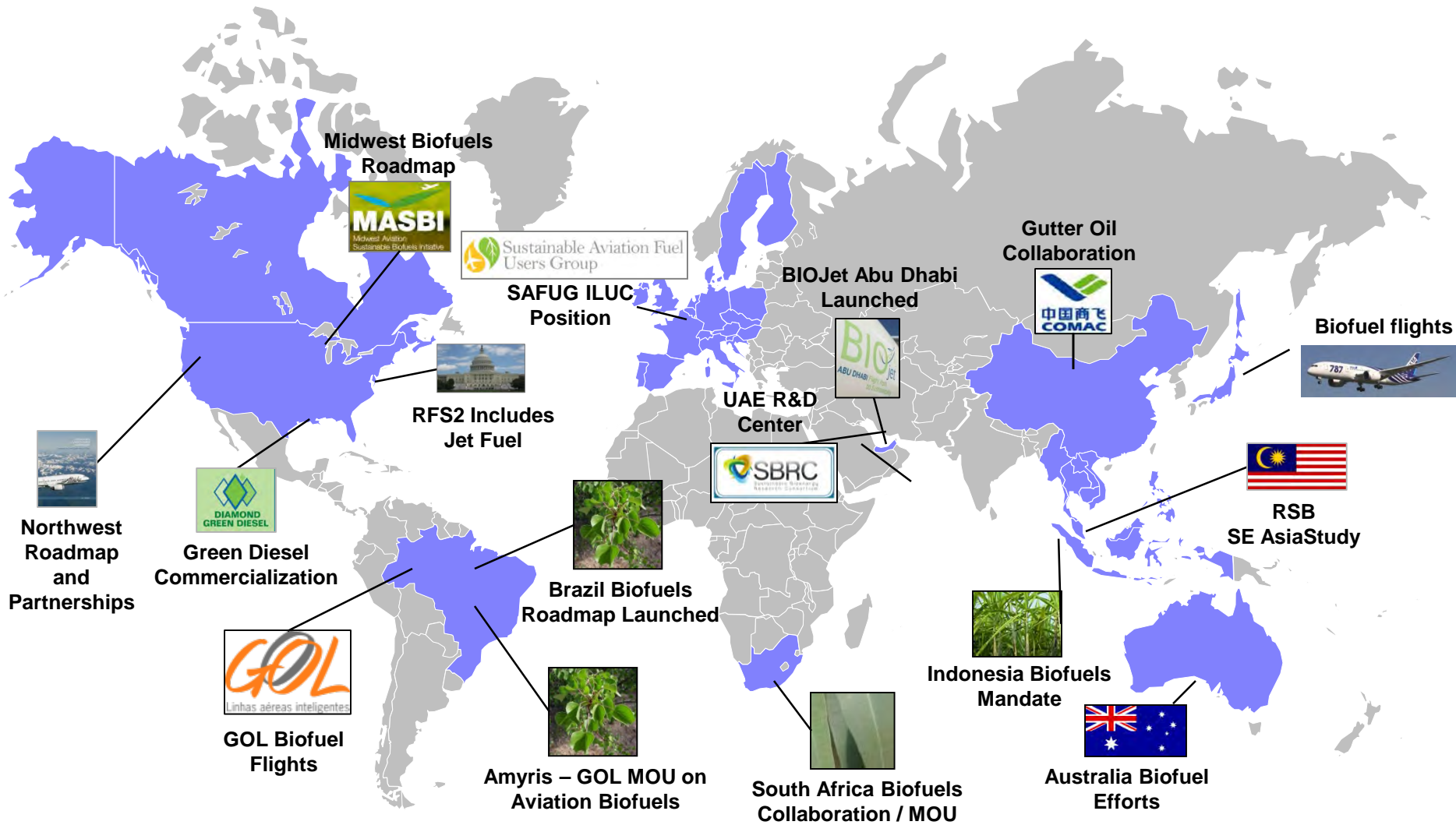


Fuels approval



Boeing's Global Biofuel Program

Key Activities



Working across Boeing and the industry to drive commercialization

Broad Demand for Aviation Biofuel



Test Flights
2008 - 2011

Early commercial flights
2011-2012

Ongoing operation
2013+



NAVY



AIR NEW ZEALAND



Continental Airlines



AEROMEXICO



State of Aviation Biofuel Industry



✔ Technically viable



ASTM and Def Stan approved

High quality standard

✔ In demand



Airline support

In commercial use

Strong US Military Demand

✘ Sufficient supply



Refinery capacity small

Price premium

Limited sustainable feedstock

The continuing challenge

\$30

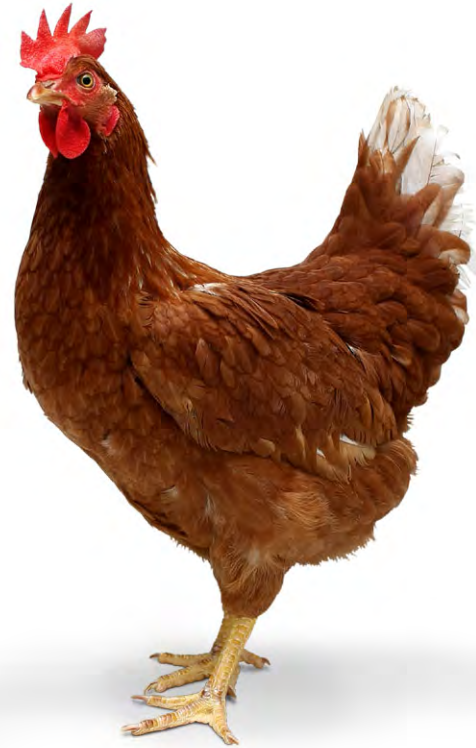
The price premium of aviation
biofuel used for demo flights

\$0.10

The price premium that would
eliminate 2012 airline profitability

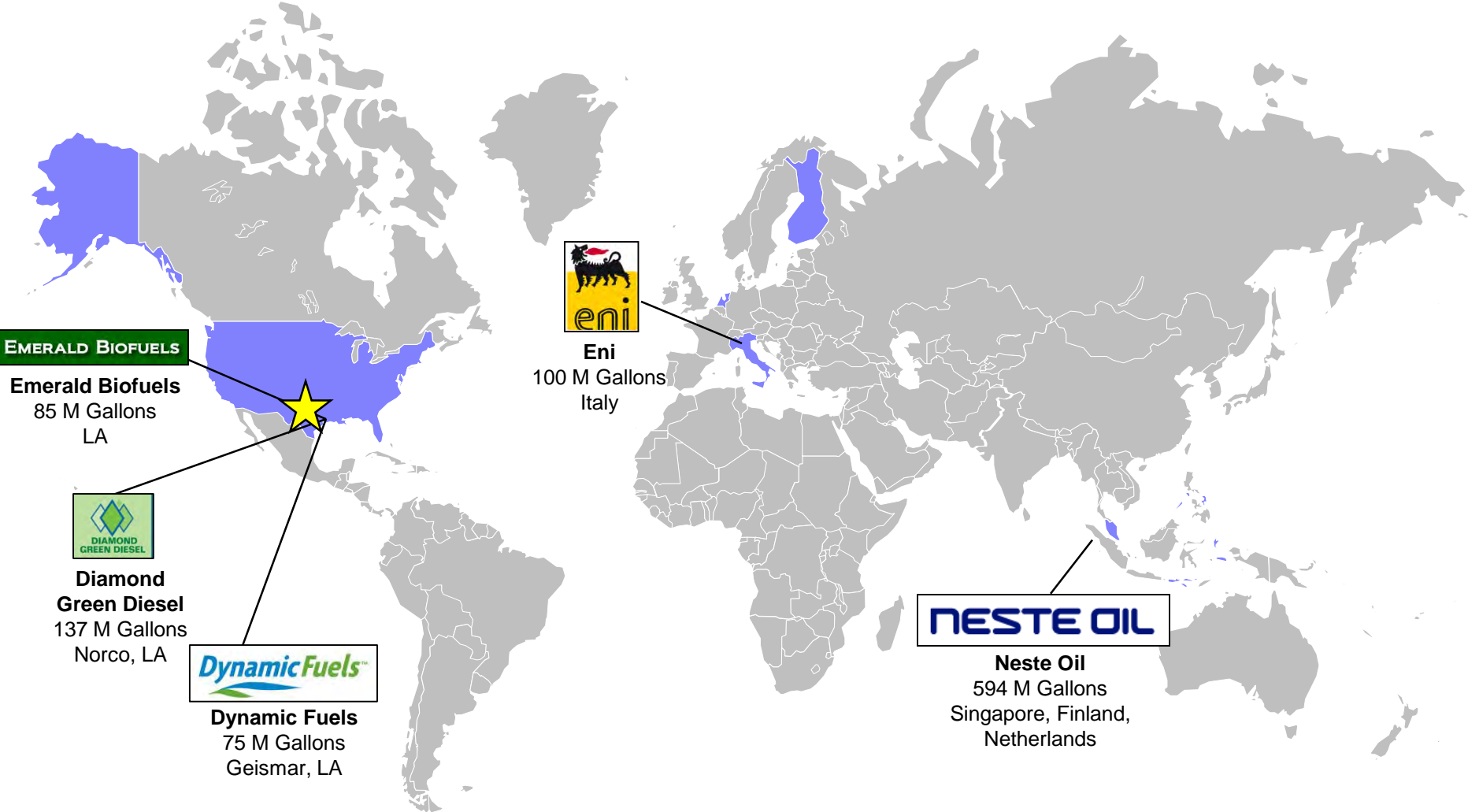
Notes: Prices per gallon. \$0.10 based on long term net margins of 1% and assumption of 1/3 of costs being fuel.

Scale?



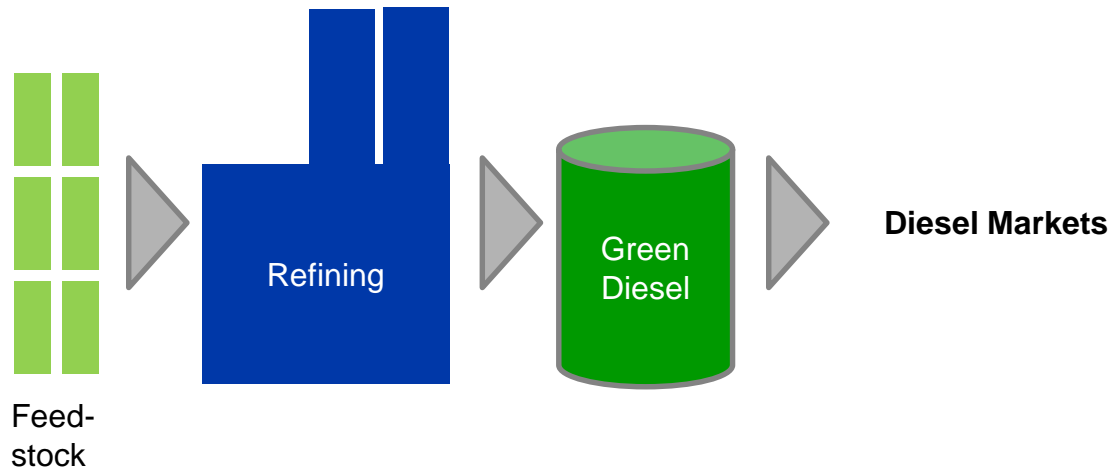
Price?

Global Green Diesel Production

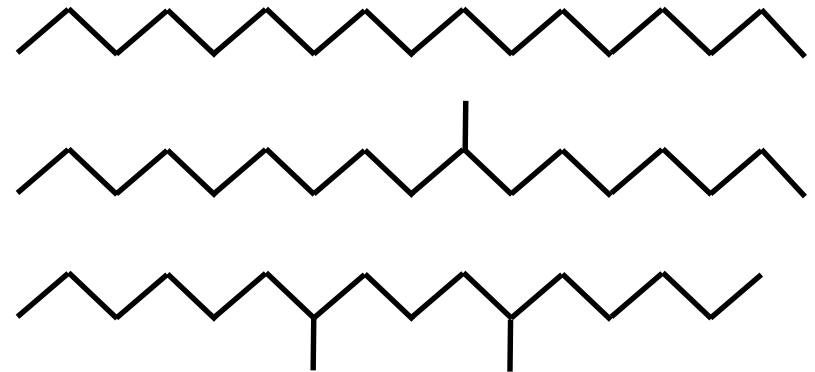


Advanced biofuels, commercialized

Green Diesel is a drop-in fuel

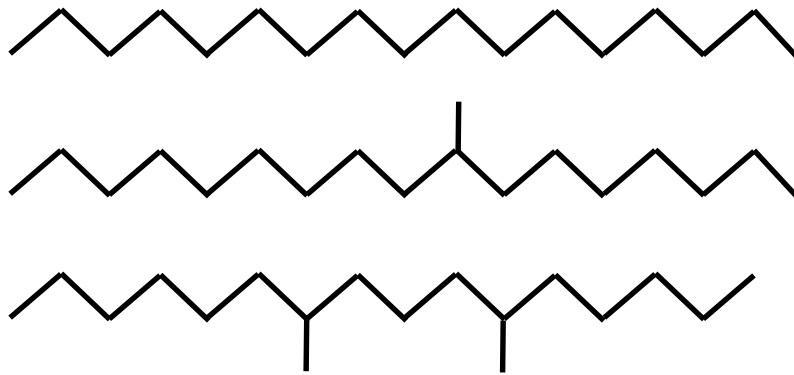
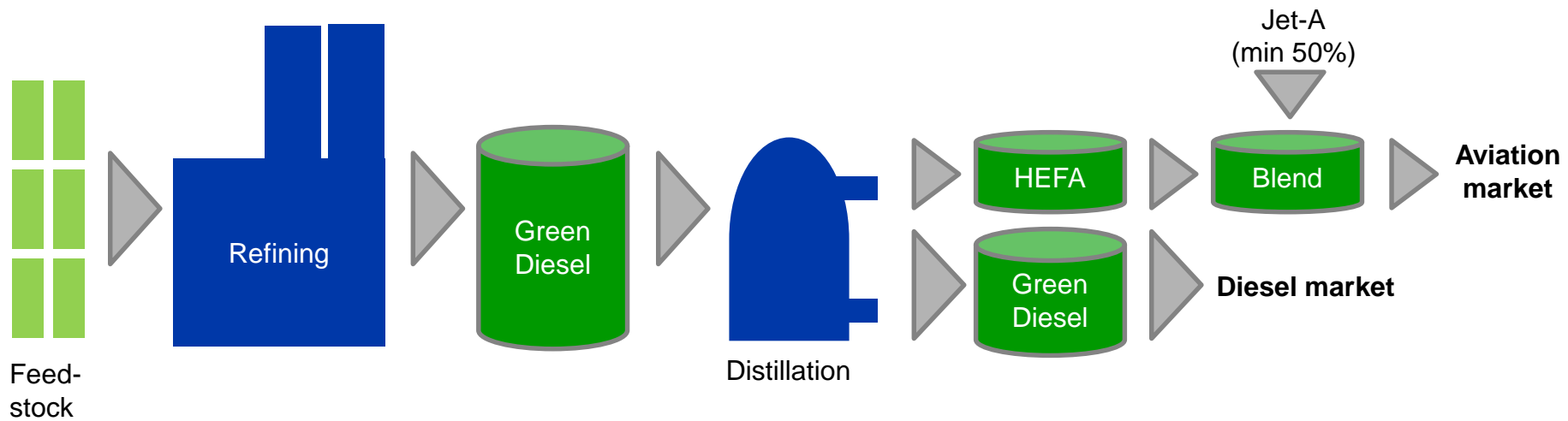


Biodiesel

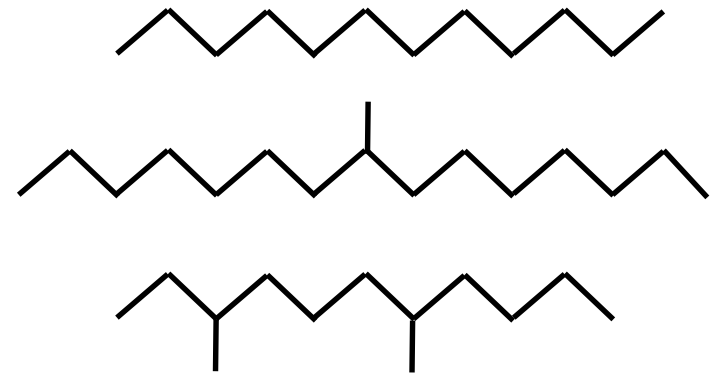


Green Diesel

HEFA is a premium fuel



Green Diesel



HEFA

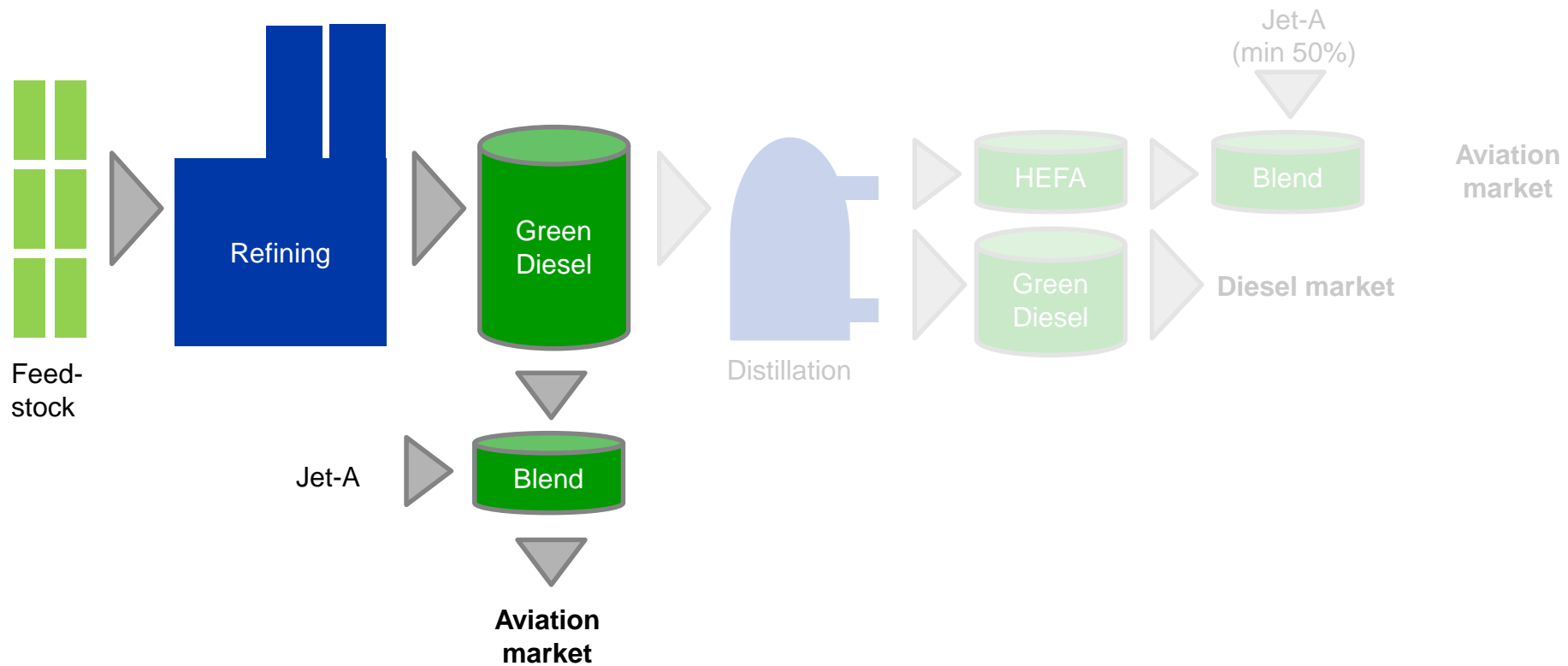
The breakthrough



Dr Jim Kinder, Boeing Technical Fellow

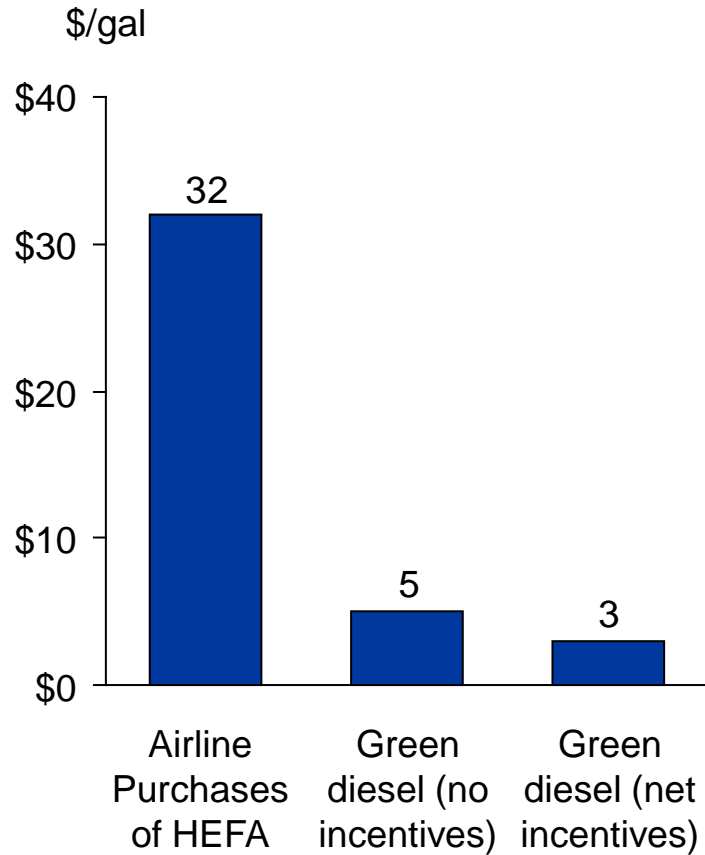
Green diesel is similar enough chemically to be blended directly into jet fuel

Drop-in aviation biofuel, without the premium

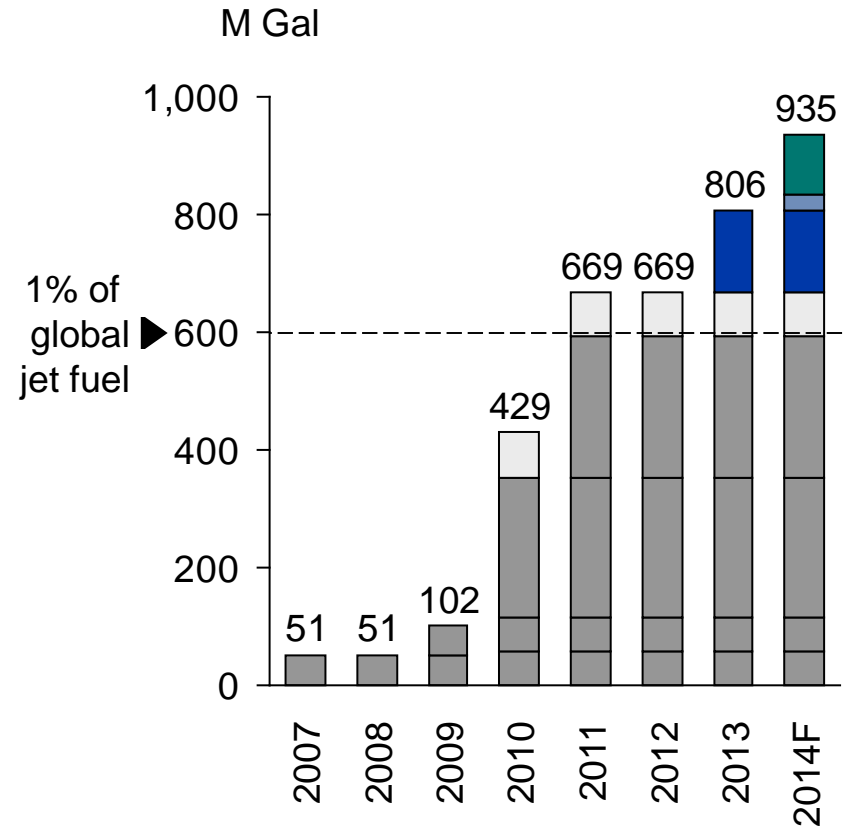


Significant impact expected

Competitive price



Instant scale



Sometimes, the breakthrough is not in technology

Sustainable Biomass Research Consortium



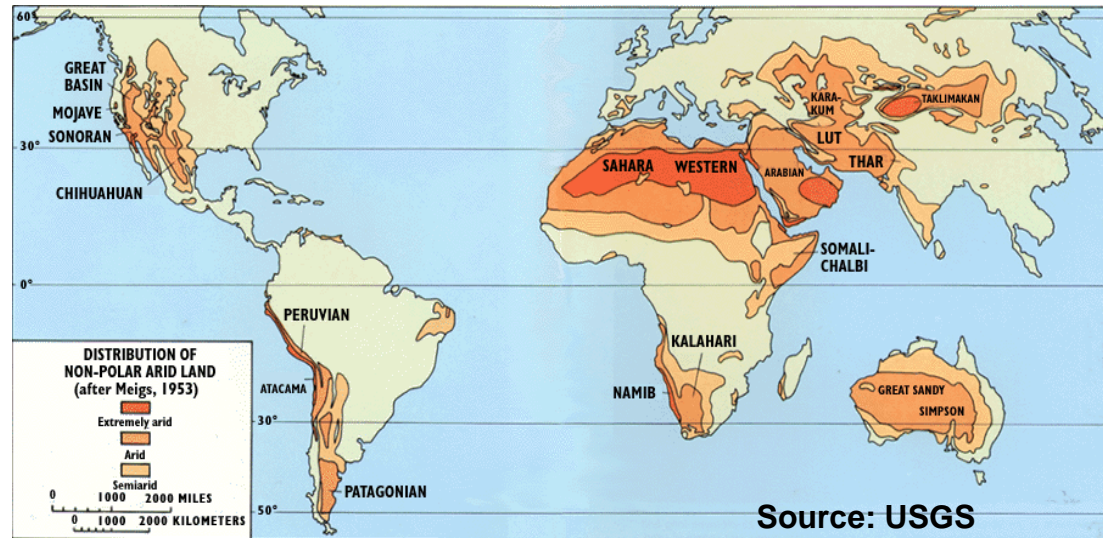
Why is SBRC research important?

Our concept for biofuel production could be applied to the UAE and many other regions of the world

97% of the Earth's water is in the oceans

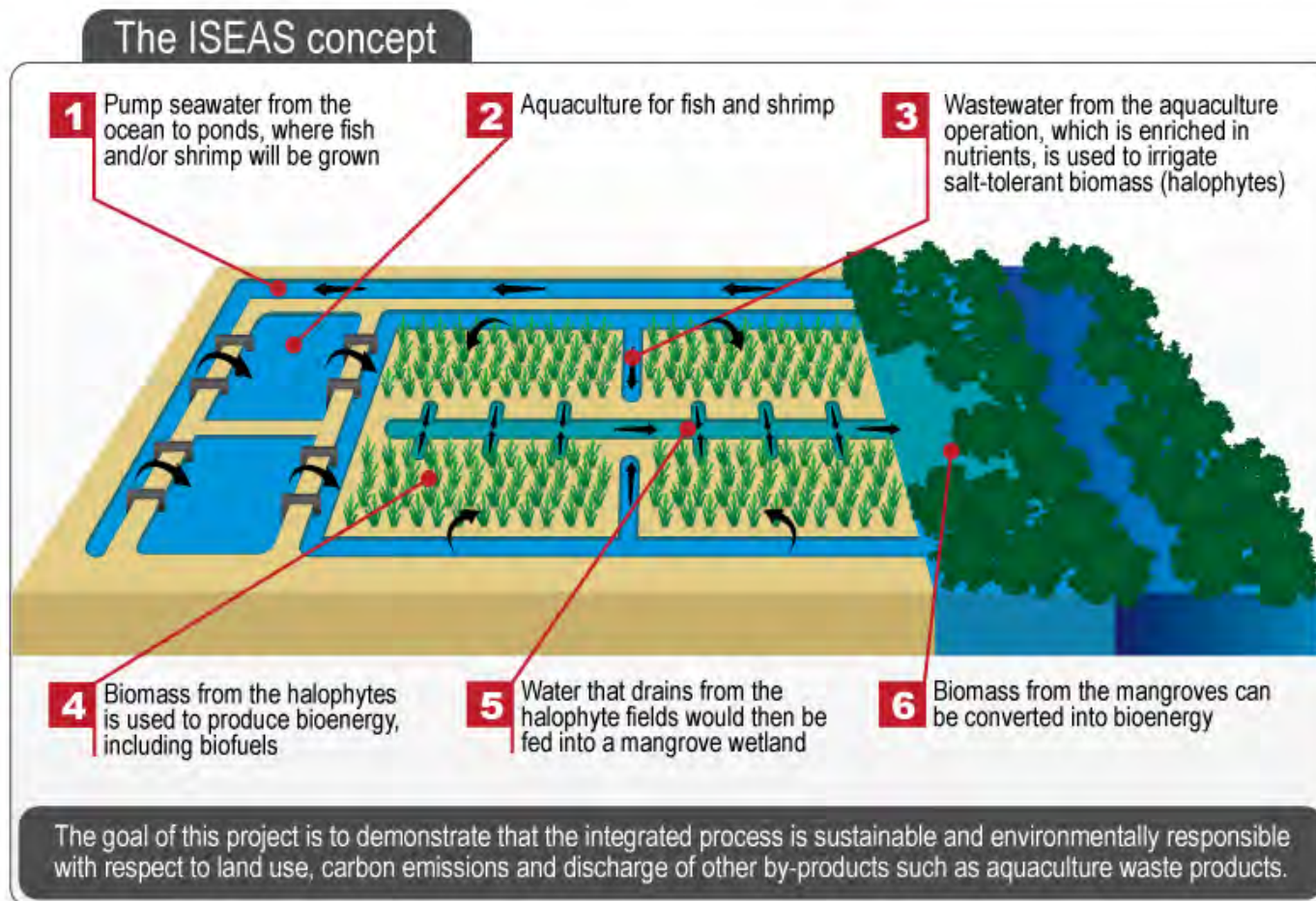


About 20% of the Earth's land mass is desert ~25.5 million km²



The ISEAS

The flagship project of the SBRC is the Integrated Seawater Energy and Agriculture System



Moving From Dreams to Reality



Aviation Biofuel Progress

- ASTM approval for commercial use
- Organized demand
- Favorable policy developments
- Commercial flights continue

Next Steps

- ASTM approval of green diesel blending
- Emphasis on policy continuity
- Research – expanded feedstocks/pathways
- Innovation – supply chain and commercial



Questions?