

RENEWABLE DIESEL SCALING IT TO THE FEEDSTOCK SUPPLY



Luca Zullo
VerdeNero, LLC
luca.zullo@verdenero.com
651-270-6478

WHAT IS RENEWABLE DIESEL?

RENEWABLE DIESEL AND **BIO-DIESEL** are both made from renewable feedstocks
BUT ARE DIFFERENT MOLECULES

RENEWABLE DIESEL

- Chemically indistinguishable from diesel fuel (Drop-in)
- No blend constraints, same equipment, no pipeline restrictions.
- Same energy density of diesel
- Cetane No >70
- Cloud point: customizable, as low as -50C
- Renewable Jet-A possible
- #1 and #2 diesel by changing operating conditions

BIO-DIESEL

- Fatty Acid Methyl Ester (oxygenated)
- Limited to B20
- Constraints in the use of the petroleum infrastructure
- Cetane ~45-50
- 90% Energy content of diesel
- Cloud point ~ -5C
- NOx emission may be higher

$\Delta \sim \$1/\text{gal}$

Typical premium for renewable diesel over
biodiesel in the marketplace

SUITABLE FEEDSTOCKS

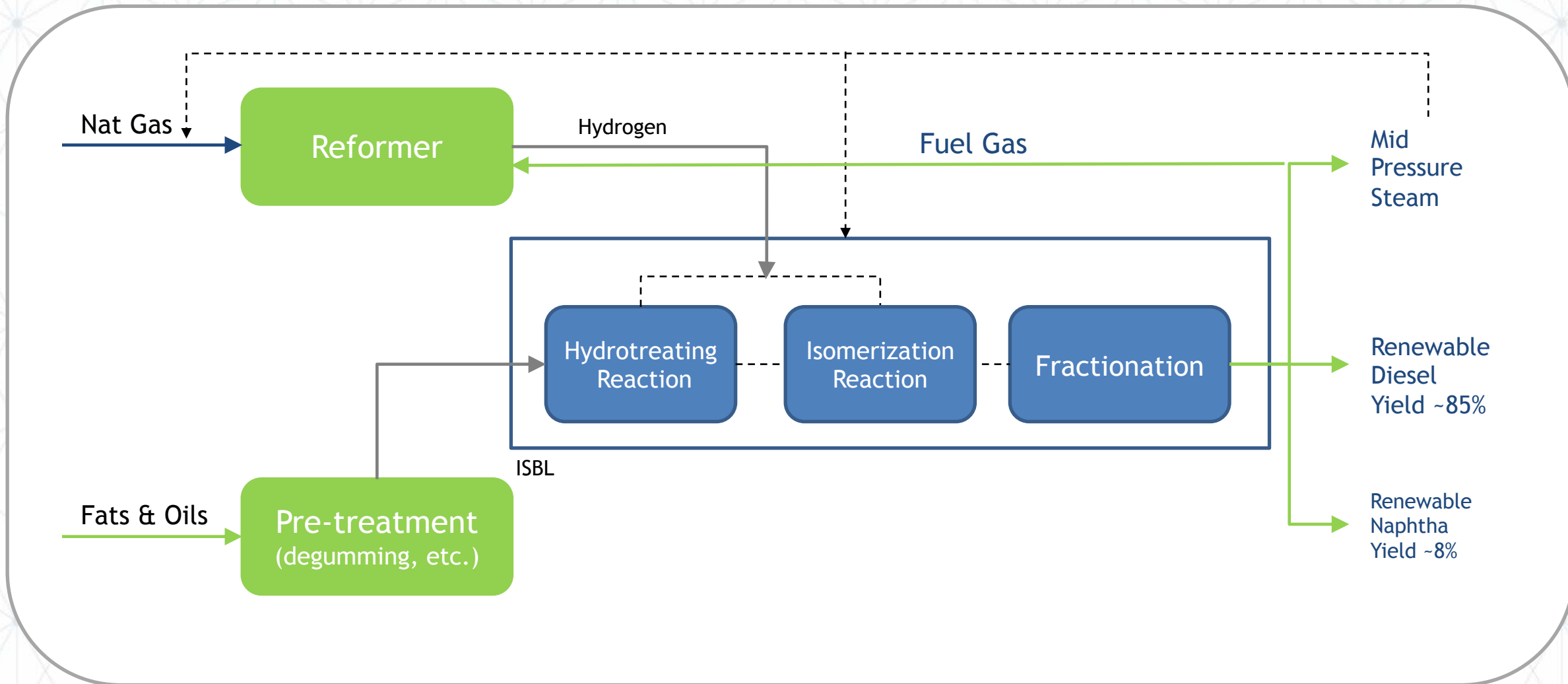
- Used Cooking Oils (UCO)
- Yellow Greases (waste veg. oils and animal fats)
- Distiller Corn Oil
- Tallow
- Acid Oils
- Algal Oil
- Tall Oil and Tall Oil Fractions
- Any vegetable oil



- Waste and Processing Residues
- Low Carbon Intensity Feedstock
- Qualify for higher compliance value in key jurisdictions (CA LCFS, EU REDII)

NO LIMITATION ON FFA%

THE RENEWABLE DIESEL PROCESS IN A NUTSHELL



... WITH MASSIVE POTENTIAL IN CALIFORNIA ALONE

Total Sales on road diesel and jet fuel in California (includes bio-based)

2018 actual ~ 550,000 barrels per day

Plenty of headspace for Renewable Diesel to grow:

- No blending constraints
- Low CI Renewable Diesel necessary to meet compliance goals

Sales of Bio-Based Diesel in California for LCFS Compliance

2020 estimate¹ ~ 100,000 barrels per day

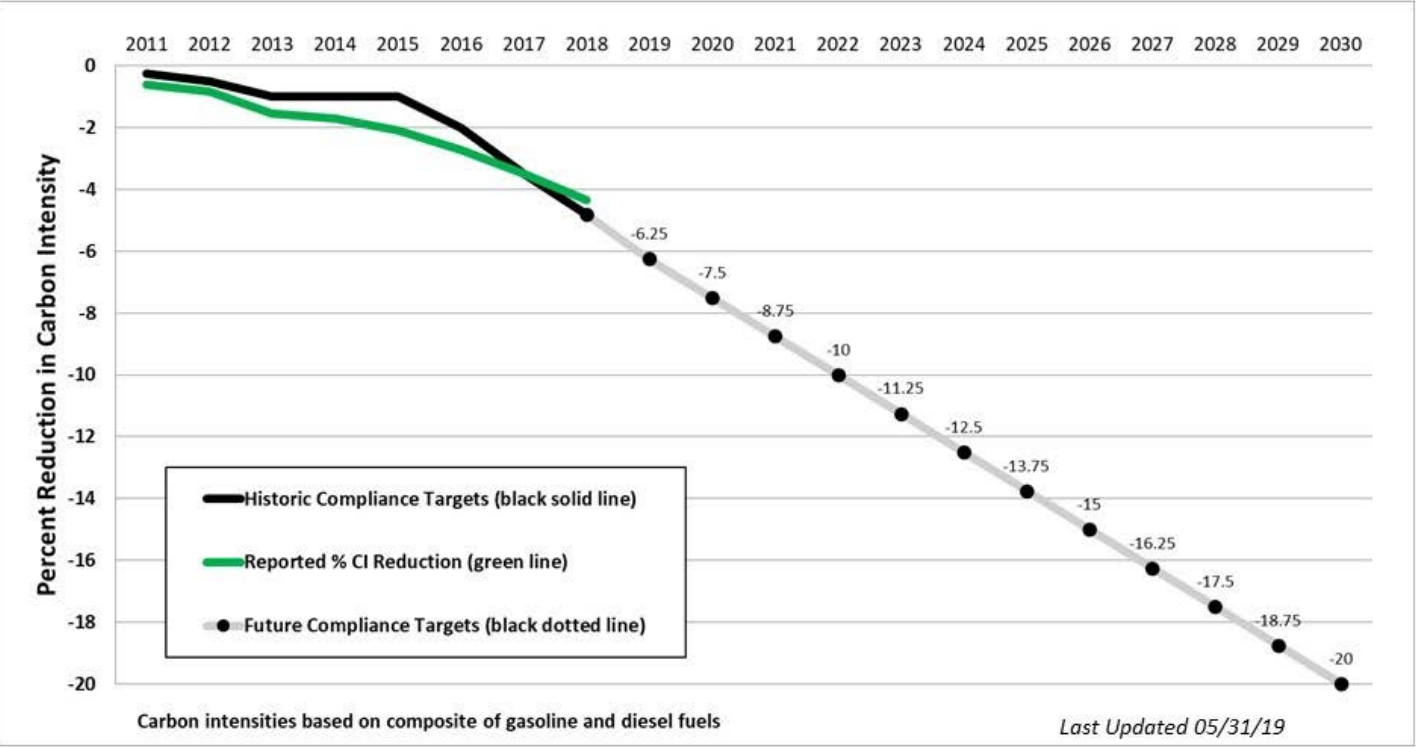
2018 actual ~ 40,000 barrels per day



OTHER STATES ARE ADOPTING THE CA LCSF OR SIMILAR PROGRAM

RENEWABLE DIESEL: COMPLIANCE VALUE (US)

California LCFS: Mandated Carbon Intensity Reduction (%)

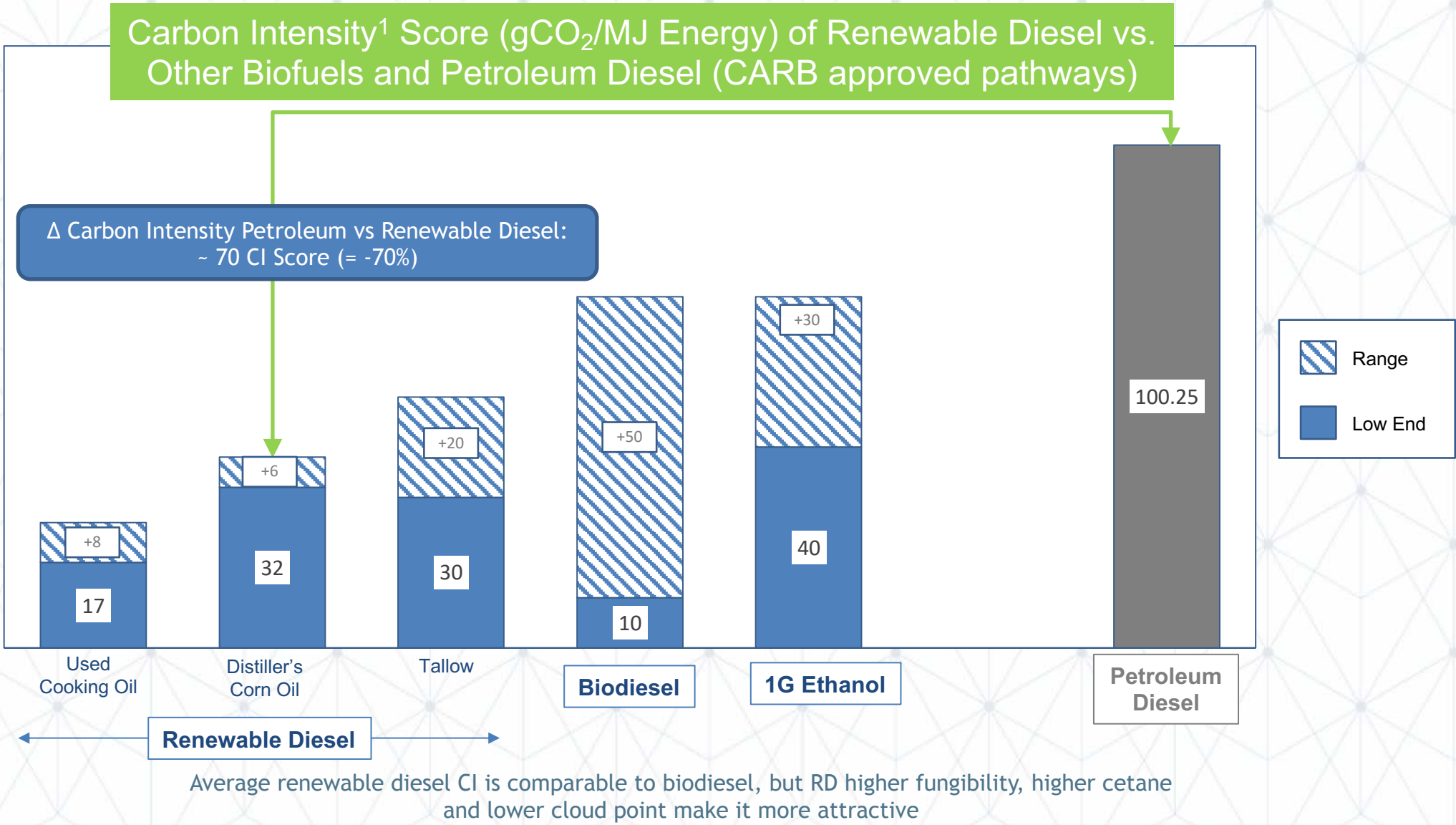


RFS Volumetric Obligations


	2020
Cellulosic biofuel (million gallons)	540
Biomass-based diesel (billion gallons)	2.43
Advanced biofuel (billion gallons)	5.04
Renewable fuel (billion gallons)	20.04

US Compliance Value driven by the California Low Carbon Fuels Standard and the Federal Renewable Fuels Standard

RENEWABLE DIESEL: DELIVERS OUTSTANDING CARBON INTENSITY REDUCTIONS



RENEWABLE DIESEL IS A WELL-ESTABLISHED PRODUCT AND MARKETPLACE ...

 Plants under construction/expansion

Geographic spread of HVO plants



Note: Including industrial plants under construction | Source: Greenea; Industriell Energi AB

Global expected relative market share in HVO market by 2020E (%)

Company	Capacity p.a. (MT)	Market share (%)
NESTE	~2.510	37%
Eni	~1.130*	17%
DIAMOND GREEN DIESEL	~800	12%
TOTAL	~500*	7%
SB مركز باهيا للتكرير BAHIA REFINERY CENTER	~400*	6%
EMERALD BIOFUELS	~280*	4%
REG	~250	4%
BR PETROBRAS	~230	3%
Others	~665	7%
Total	~6775	100%

THE MARKETPLACE IS CURRENTLY DOMINATED BY OIL REFINERS



Being that Renewable Diesel is produced with petroleum refining technologies, conventional wisdom wants that the production of RD is economically viable only:

- At very large scale (industrial economies of scale are everything)
- Co-located with a petroleum refinery

This Conventional Wisdom is convenient for Big Oil

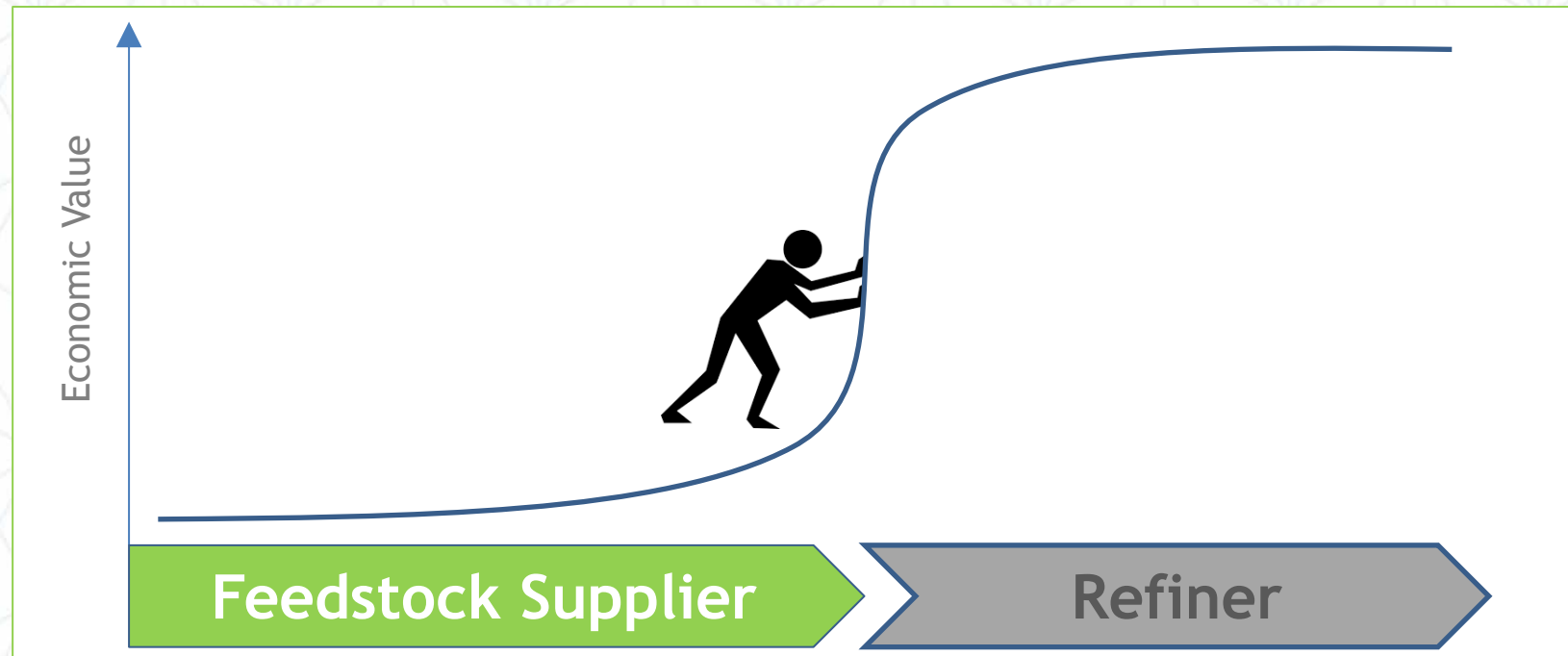


RENEWABLE DIESEL - REFINERS CAPTURE THE ECONOMIC VALUE



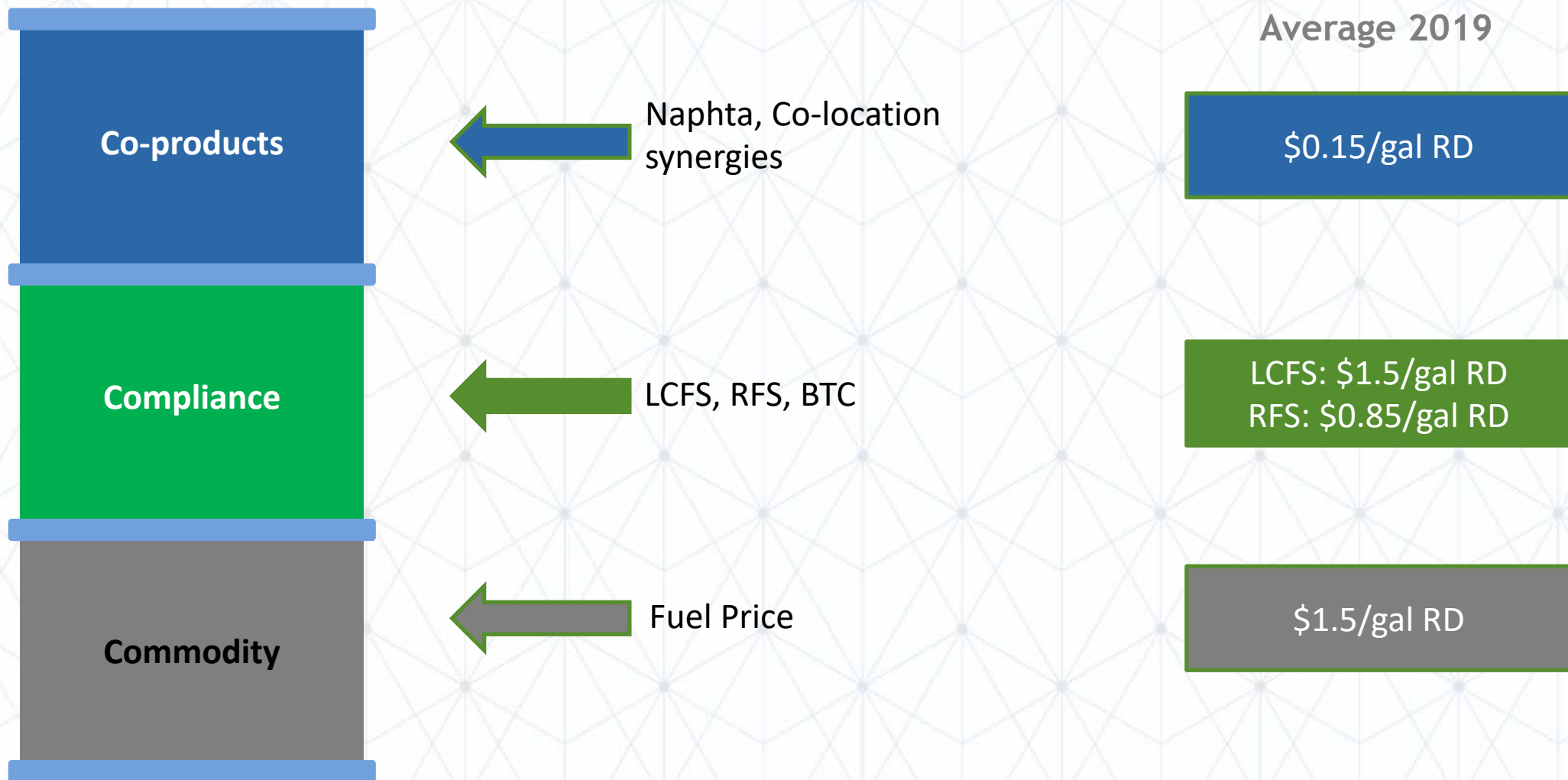
This Conventional Wisdom is convenient for Big Oil

Because the production of RD unlocks the compliance value of the feedstock as a biofuel → such conventional wisdom shifts the economic value downstream, away from the Feedstock Supplier

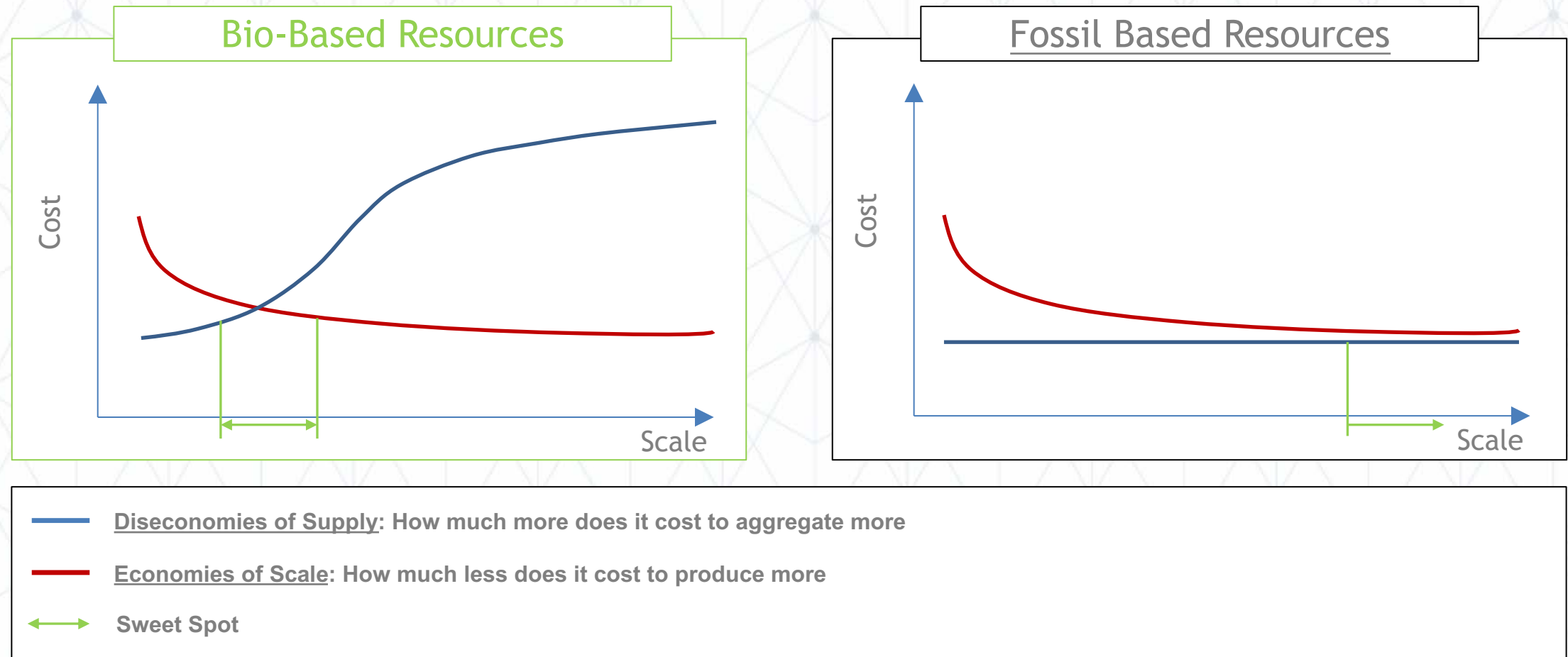


... BUT it is NOT TRUE

RENEWABLE DIESEL: 3 COMPONENTS CONTRIBUTE TO VALUE



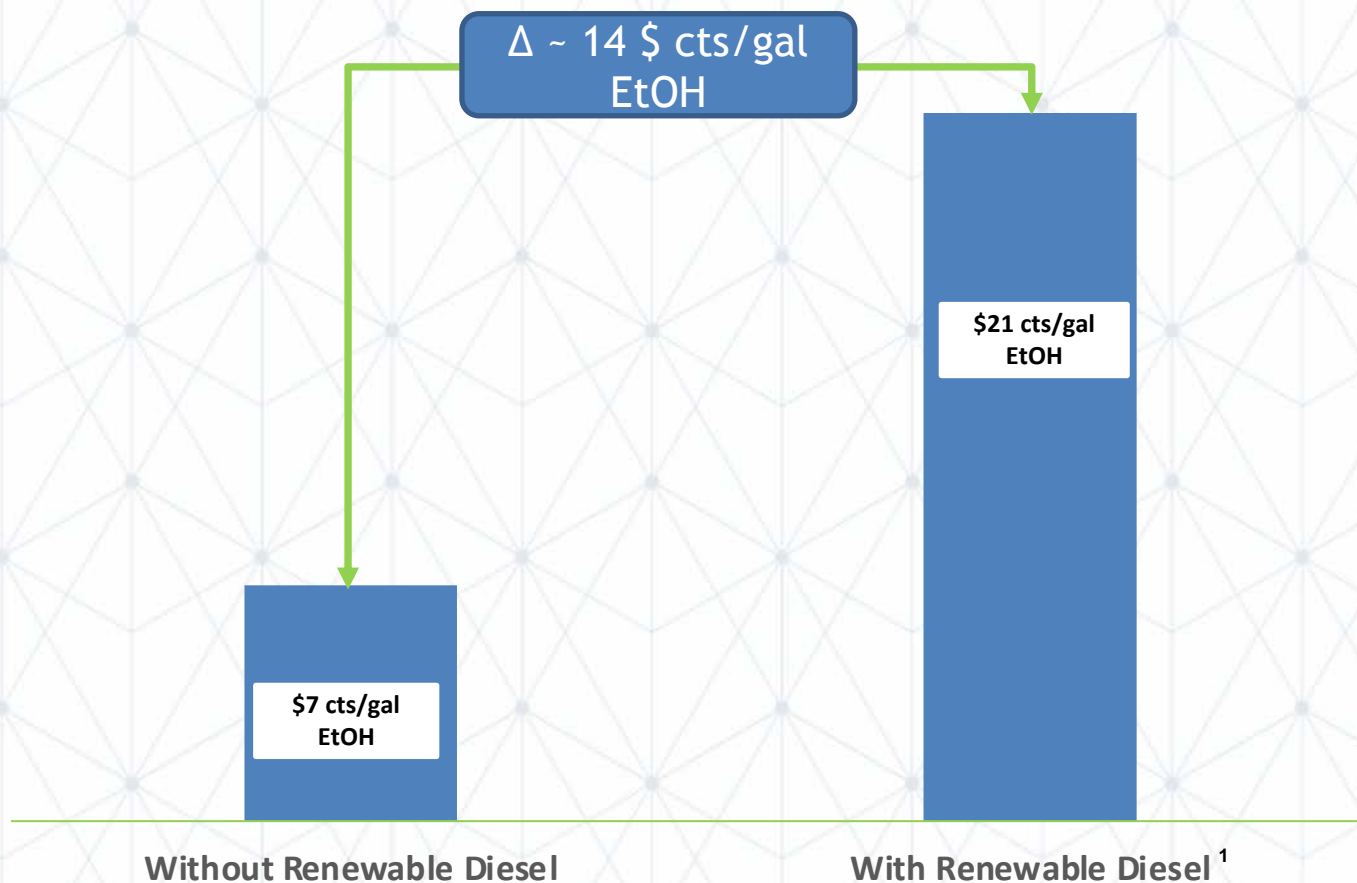
RENEWABLE DIESEL - DISECONOMIES OF SUPPLY MATTER FOR BIO-BASED RESOURCES



- Economies of Scale dominate the economics of fossil resources
- Diseconomies of Supply matter more in the economics of many bio-based resources
 - Aggregating bio-based resources (especially residual resources) is expensive

RENEWABLE DIESEL: INCREASING PROFITABILITY OF CORN ETHANOL DRY MILLING

CRUSH MARGIN (\$/GALLON ETHANOL) IMPACT OF RENEWABLE DIESEL



Key Assumptions

- Corn Price: \$4.25/bu
- Ethanol Price: \$1.3/gal
- Natural Gas Cost: \$3.5/MMBtu
- DDGS Price: \$140/ton
- Corn Oil Value: \$0.25/lb
- External Corn Oil Purchases: 44 MMLbs/yr
- Renewable Diesel Price: \$3.75/gal

1: 10 MMGPY Renewable Diesel Facility

RENEWABLE DIESEL - BRINGING THE ECONOMIC VALUE IN YOUR FEEDSTOCK BACK TO YOU



Have partnered to provide a standard RD solution right sized for feedstock owners



RENEWABLE DIESEL: A PROVEN TECHNOLOGY AT SMALLER SCALE

4.5 MGPY CAPACITY Plant



Feedstock: Distillers Corn Oil



- Ethanol plant in Garnett, KS
 - 40 mgy corn ethanol plant
 - Uses own DCO and source additional from a nearby mill
- Site is operational (September 2020)
- Operational History
 - Original Start-up in 2016
 - Increased capacity by 50% in 2017
 - Hydrocarbon Yield in the 90-92% range
 - Upgraded H2 facility in 2019/2020
 - Seamless integration with the ethanol facility



RENEWABLE DIESEL - DERISKING PROJECT DELIVERY FOR FEEDSTOCK OWNERS



- Pre-Treatment Technology
- Small scale hydrogen reforming
- Refining know-how
- Modularization experience
- Full EPC wrap
- Performance guarantees

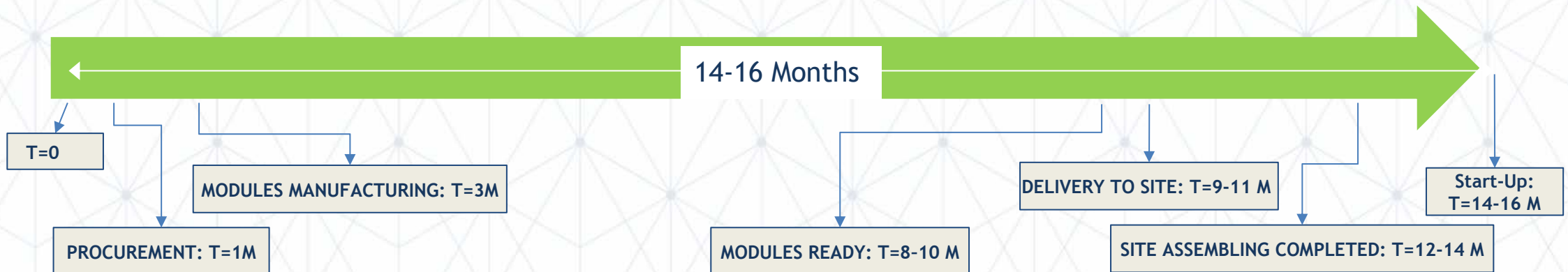


Renewable Diesel Project

- Lump sum, turn-key project
- 4 standard modules: 5 -10 - 20 - 30 MMGPY (ISBL pre-engineered)
- Grey field site



- Core process technology
- Experience with DCO
- Knowledge of corn ethanol facilities integration
- Commissioning, start-up and operational support
- Training



MAIRE TECNIMONT GROUP - OVERVIEW

OPERATING COMPANIES



HYDROCARBONS

RENEWABLE RESOURCES

PRESENCE IN THE WORLD

~9,300

EMPLOYEES &
PROFESSIONALS

50

OPERATING
COMPANIES

45

COUNTRIES

FY 2019 RESULTS

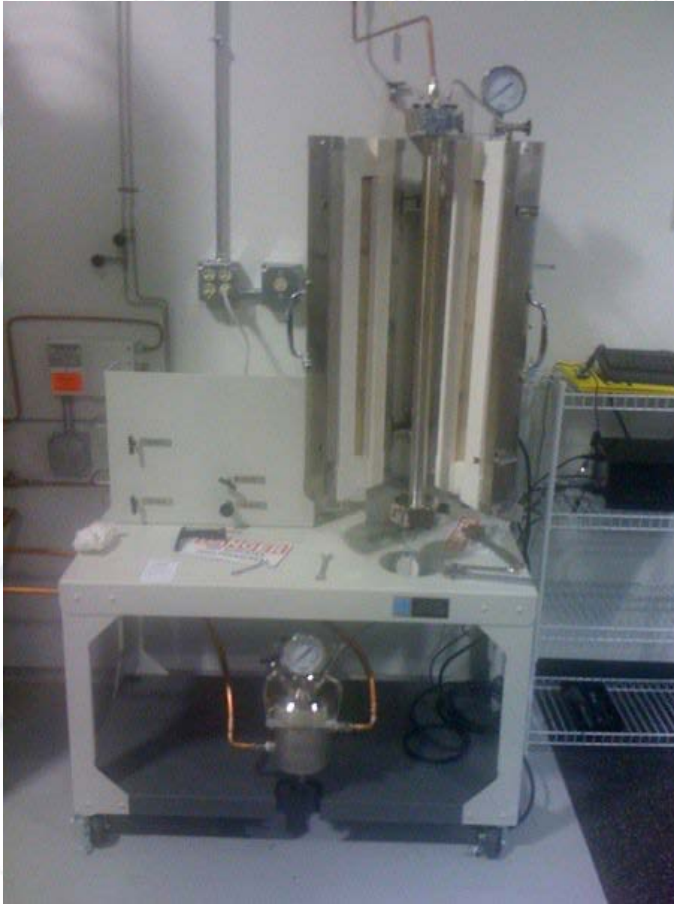


\$3.75 BLN
REVENUES



\$250 MLN
EBITDA

QUESTIONS?



Setup I used to test synthesis of RD from DCO in 2009 with a grant from the MN Dept of Agriculture

Thank you for your attention and interest!