



Profiting From Supercritical Biodiesel

Why “Supercritical” Biodiesel
Will Give You An Edge Over
The Competition

Jatro Renewables[®]
SUSTAINABLE CHEMISTRY FOR EARTH

Jatro Renewables: Innovation To The Biodiesel Industry



2004



2010



2015

The Evolution of Jatro Renewables

- 2004, Transesterification: Refine to 2% FFA
- 2009, Esterification: Refine to 15% FFA
- 2015, Supercritical: Refine to 100% FFA
- 2017, Renewable Diesel

20 Biodiesel Plants Built or Re-Engineered Since 2004



Biodiesel Plants Outside US

- 5 Mt Coco Products, Philippines
- 9 African Energy Initiative, Kampala, Uganda

* Supercritical technology plants

** Under construction (est. completion June 2018)

200 Million Gallons Per
Year of nameplate
capacity production

Advantages of Supercritical* Process vs. Traditional?

- ~38% . . . approximate amount *Super*TM lowers total biodiesel production cost vs. traditional
- 100% . . . FFA feedstock can be used to lower cost of feedstock choice by half or more
- >95% . . . purer glycerin by-product, as *Super* process uses no catalyst to contaminate it
- 0° C . . . cloud point after final distillation, renders a clear biodiesel suitable for use in winter



(Left) A feedstock blend of used cooking oil, corn oil and trap grease with a combined FFA of 65%.
(Right) ASTM 6751, B100 after processing with *Super*TM process

* Jatro Renewables has trademarked Supercritical as *Super*TM

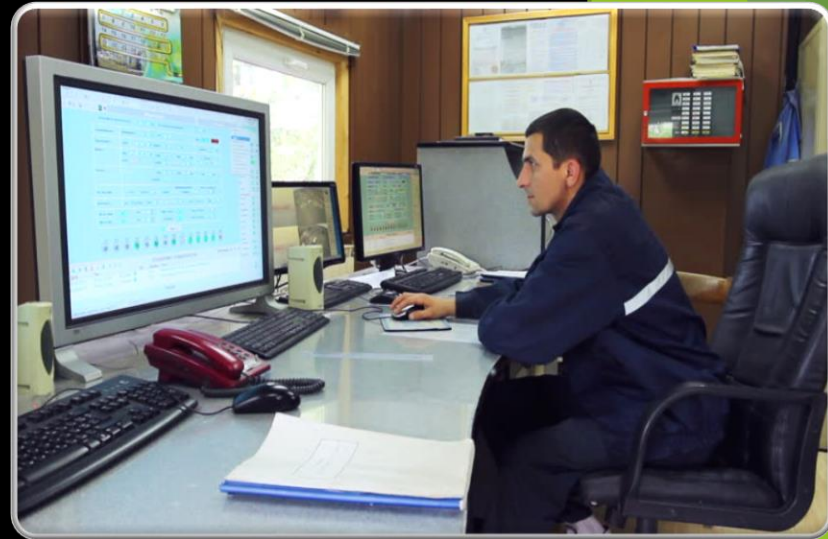
A Higher Quality Biodiesel With The Super™ Process

- ASTM* D6751-15 provides biodiesel specifications
 - 18 tests (in current ASTM version)
 - Includes both quality and performance indicators
 - No specification constrains feedstock options
 - Insures ASTM specification meets minimum quality
- **Certificate of Analysis**
 - A CoA typically available for every lot of biodiesel
 - Provides a complete list of specifications and test results
 - May contain additional tests beyond ASTM D6751



Super™ Process Includes Careful Quality Assurance

- Quality Assurance Program (QA)
 - Created for the biodiesel industry by the industry
- Producers & Marketers
 - Rigorous, externally-monitored quality programs
 - Producer: no off-spec. biodiesel leaves the plant
 - Marketer: no off-spec. biodiesel leaves the terminal
- *Super*™ Process Includes Optional content tests for:
 - Mono-, di-, and triglyceride
 - Moisture
 - Particulate contamination
 - Esters Content



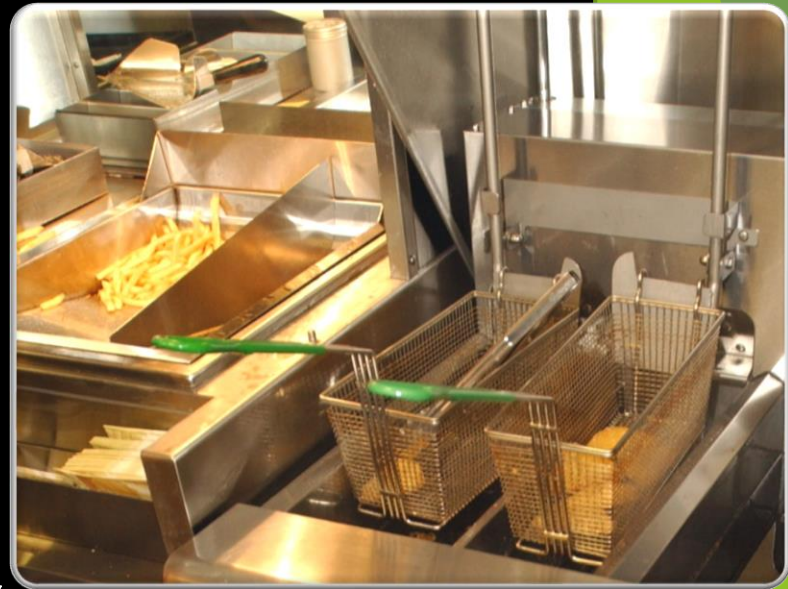
Super™ Distilled Biodiesel For The Highest Quality Fuel

- Distillation purifies liquids by a process of evaporation and condensation
 - Petroleum distillation produces different cuts to get gasoline, kerosene, diesel, etc.
 - Methyl ester distillation creates a purified biodiesel
- A purer product that blends better with #2 (ULSD) diesel
 - Superior cold weather operation
 - Greater feedstock flexibility
 - Dependable supply & pricing
 - Higher Cetane
 - Lower Carbon Intensity



Benefits of Biodiesel

- Drop-in diesel replacement to 20%
- Feedstocks are primarily fats, oils, and greases left over from protein production or restaurant use, e.g.:
 - Inedible corn oil
 - Animal fats
 - Municipal trap grease
 - Used cooking oil
 - Soybean oil
- Reduces GHG emissions >60%
- Blends with petrodiesel in any percentage
 - Once blended does not drop out



Benefits of Biodiesel

- **Adds lubricity to diesel engines**
(Lost when sulfur reduced from about 500 ppm in 2012)
- **Higher cetane**
 - Over 50 vs. petrodiesel at about 41
 - Smoother, more complete burn
- **Close to zero sulfur**
 - Typically less than 5 ppm, whereas petrodiesel is about 10
- **Almost zero aromatics**
 - Reduces toxicity
- **About 10% oxygen**
 - Reduces black smoke particles, burns cleaner



Biodiesel is non-hazmat rated

Economics of Biodiesel

- Typical Production Costs and Margin for *Super*TM
 - Table considers 4 feedstock blends at various costs

Entry Items	100% Corn Oil	50% Corn, 50% UCO	30% Corn, 35% UCO, 35% Brown	15% Corn, 15% UCO, 70% Brn.
Feedstock Cost Per lb	\$0.28	0.25	0.21	0.18
Total Feedstock Cost/gal	2.11	1.89	1.59	1.36
Processing (freight in/out)	0.49	0.49	0.49	0.49
G&A	0.06	0.06	0.06	0.06
TOTAL COGS	2.66	2.44	2.14	1.91
Glycerin Revenue	0.08	0.08	0.08	0.08
B100* Revenue (10/5/17)	3.20	3.20	3.20	3.20
TOTAL REVENUE/gal	3.28	3.28	3.28	3.28
Margin (ebitda)/gal	\$0.62	0.84	1.14	1.37

Avg. blended feedstock cost divd. per lb and per gallon (lbs x 7.55 = gals)

Processing includes: feedstock losses, chemicals, energy, labor and plant maintenance

General and administrative: accounting, insurance, commissions, rent etc.

Value per gallon of biodiesel is double or more vs. glycerin from traditional processes

- Traditional plant margins 35% to 80% less using same blends except brown grease (col. 4 above) as traditional process can not refine over 15% FFA oils

* Includes RINs and \$1.00 tax credit if credit is in force. In this example credit is shared 50/50 when Congress re-enacts it—as they have done every year since 2007

Economics of Biodiesel

- Margins For Diesel Fuel Retailers for *Super*[™] (B20)

Entry Items Per Gallon	Prices
NYMEX Heating Oil (HO) 03/12/18	\$1.88
Price B100 Dlv'd. Rack/Blender	3.20
Less Heating Oil Value	1.62
Less RIN Value @ \$0.77 x 1.5	1.15
Price Basis To HO w/o RINs, delivered:	HO+0.17
Net Cost At Rack (after blending)	2.05
Margin Under ULSD for B100	0.21
Margin Per Gallon of B20	\$0.042



- The typical margin for a gallon of ULSD is \$0.15 to \$0.25. Therefore, biodiesel adds from 23% to 14% additional margin.

Tax Subsidies, RFS And LCFS

- Federal Tax Subsidy
 - \$1.00 per gallon subsidy
 - Managed by IRS
 - Currently law on hold, congress needs to vote
- Renewable Fuel Standard (RFS)
 - Congress established a law (EISA) in 2005 to develop alternative energy
 - Managed by EPA
 - Requires refiners and fuel importers to blend increasing %ages of renewable fuel into transportation fuels
 - To opt out, refiners can buy a "pass" , called a Renewable Identification Number (RIN), a traded value attached to each gallon of renewable fuel
- California Low Carbon Fuel Standard (LCFS)
 - About \$.050 to \$1.00 per gallon depending on Carbon Intensity (CI) of the fuel; otherwise works similar to RFS.



Tax Subsidies, RFS And LCFS

- RFS: volumes Used to determine the proposed percentage standards for RFS

Fuel Type	2015	2016	2017	2018-20
Cellulosic Biofuel	106 m	206 m	311 m	238 m/y
Biomass-based Diesel	1.70 b	1.80 b	2.0 b	2.1 b/yr
Advance biofuel	2.90 b	3.40 b	4.28 b	4.24 b/yr
TOTAL RENEWABLES <i>(Includes ethanol)</i>	16.30 b	17.40 b	18.5 b	21.0 b

- LCFS: no volume target . . . other than target of 50% renewable transportation fuels by 2035 (and extended if not met)

How The RFS Program Works

- Renewable Fuel Standard Process
 - Tracking system to measure RFS2 compliance
 - Each qualifying gallon of renewable fuel has its own unique number called a renewable identification number (RIN)
 - Every gallon of B100 produced generates “D4” class RINs
 - The RIN value is determined by the market as they are a tradable commodity
 - Fuels (not just biodiesel) have different energy levels. A biodiesel D4 gallon has 50% more energy than ethanol and is worth the value of the D4 RIN x 1.5 (called “equivalence value”)
 - Obligated parties meet their EPA-regulated volume obligation by blending renewable fuel or instead accumulating (buying) RINs
 - RINs are detachable and trade actively among producers, obligated parties, and traders
 - RIN prices are a mechanism to balance supply and demand.

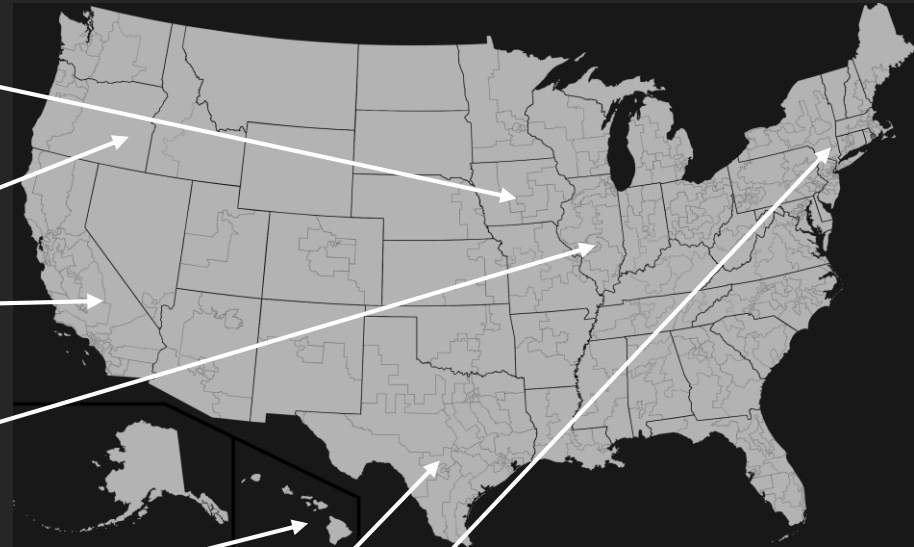
How The RFS Program Works

- Examples of Obligated Parties



Biodiesel blended fuels have a positive impact when taking advantage of state tax incentives:

- **Iowa:** Eligible for a 4.5 cent retail tax credit per gallon for B5 biodiesel, and 3 cents per gallon for blends of B11 or more
- **California, Washington and Oregon:** LCFS creates tremendous biodiesel economics
- **Illinois:** Biodiesel blends of B11 and above exempt from state excise tax
- **Hawaii:** 10% blending mandate proposed (2017)
- **Texas:** \$0.20/gal. at retail for B99 blended
- **New York:** Mandate for B5 in heating oil



Many other States and Canada planning to implement California's LCFS program

Biodiesel Myths Destroyed

- The Merits of Biodiesel

Myth	Reality
Car and Truck manufacturers (OEMs) do not warranty engines for Biodiesel	Almost all do: OEMs making diesel engines cover engines 100% when using up to a 20% blend of biodiesel to diesel
Biodiesel is made from soy and takes food out of the food supply chain	No truth to this. Also, 70% of biodiesel is made from waste cooking oils and waste animal fats, fish oil and inedible corn oil etc.
Biodiesel made from used cooking oil, trap grease and other low forms of grease do not make quality biodiesel	No truth to this. Many types of grease can be conditioned to make the highest quality biodiesel. Some at very low cost.
Biodiesel clogs fuel filters	No truth to this: During the first month of use all fuel line filters should be checked as the biodiesel will be cleaning build-up in lines, tank and injectors . . . and leaving it in the filters.
Biodiesel is not that good for engines in the long run. Does not help an engine	No truth to this: Biodiesel acts as an engine lubricant supplanting sulfur when diesel fuel contained 2000 ppm sulfur, now its below 15 ppm by law
Biodiesel has a low cetane, so less power, poor performance	No truth to this: Biodiesel has a 47 to 51 cetane vs. diesel at about 40. Engines run smoother
Biodiesel is limited to summer months	No truth to this: A 20% blend (B20) Biodiesel can be used all year, and down to temperatures as low as -30°F



For More Information about
Jatro Renewables and Biodiesel
Contact:

Ian M. Lawson
(937) 308-1230
ilawson@JatroRenewables.com

845 North Main Street
Miamisburg, OH 45342

JatroRenewables.com