

Table 3. Biodiesel Technology Providers

Company	Contact, Address, Phone, E-mail	Technology Description	Status of Technology	Feedstock				Processing Costs	Commercial Facility	Capital Costs	Delivery Schedule	Products	Feedstock Yield	Warranties
				Description	FFA	MIU	Pretreatment							
Ballestra	Giuseppe di Carpegna Via Piero Portaluppi 17 - 20138 Milano, Italy +39 02 5083248 giuseppe.dicarpegna@ ballestra.com	Continuous transesterification process developed in the early 1980s.	Fully commercialized with plant production capacities from two million gallons per year (mgy) to 60 mgy. Oil refining and glycerin upgrading components can be added upon customer request.	Vegetable oils and recovered fried oil			Depends upon feedstock.					Biodiesel meets most stringent European and/or ASTM standard specifications. Glycerin is 88-90% pure; however, with upgrades, pharmaceutical grade can be produced.	99.8% calculated as ratio of neutral/refined oil to produced biodiesel.	
BDT Biodiesel Technologies GmbH	Dr. L. Kondor 1130 Wien, Austria Hietzinger Hauptstrasse 50 +43 1 877 0553 dr-kondor@eunet.at	Continuous two-stage alkaline re-esterification in a compact production unit built into a 20 foot (ft.) container.	Commercialized, with existing references.	Vegetable oils, animal fats, and yellow grease	Technically, no highest limit; it is economic to process with max 10% FFA.		A vacuum oil purification unit is applicable for animal fats or yellow grease feedstocks.	For vegetable oils, 28.2 cents (U.S.) per gallon.	From 0.5, 1.0, and 2.5 mgy units; fully modular units.		Four to five months.	Biodiesel meets ASTM standard specifications. Glycerin purity is 65%. Other products include distilled FFA if present in feedstock.	98%	Twelve months full warranty, spare parts supply for 10 years guaranteed.
Biodiesel Industries	Russell Teall 435-1/2 El Sueno Road Santa Barbara, CA 93110 (805) 689-9008 rteall@aol.com	Modular production units (MPUs) fitting into a standard 40 ft. container, utilizing a wide range of feedstocks to produce up to three mgy. Patent pending.	Three commercial MPUs in operation: Las Vegas, NV (three mgy); Rutherford, Australia (10 mgy); U.S. Navy, Port Hueneme, CA (0.150 mgy).	Vegetable oils and animal fats	Unlimited	Unlimited	Depends upon feedstock.	To be provided as part of feasibility study and subject to NDA.	From three mgy to any size MPUs. Each unit requires an 8 ft. x 40 ft. footprint excluding tank farm. Three month delivery from contract and deposit.	To be provided as part of feasibility study and subject to NDA.	To be provided as part of feasibility study and subject to NDA.	Biodiesel meets ASTM standard. Glycerin quality is determined by feasibility study and subject to NDA.	To be provided as part of feasibility study and subject to NDA.	Manufacturers warranty ranges from one to 10 years.
Biodiesel International	Wilhelm Hammer Ges.m.b.H Parkring 18 A-8074 Grambach/Graz +43 316 4009 100 bdi@biodiesel-intl.com	Process technology including fresh plant oils, waste cooking oils, and animal fats that integrates a fully automatic PLS-controlled production of biodiesel.	Fully commercialized with plants in Austria, Czech Republic, Spain, Germany, Scotland, United States, and Great Britain ranging in size from 1.5 mgy to 15 mgy from a variety of feedstocks.	Fresh plant oils, waste cooking oils, and animal fats	Free fatty acids, even in excess of 20%, are no problem.							Biodiesel meets ASTM and European standards. Glycerin is nominally 80% pure. Other products include a potassium phosphate solid fertilizer.	One pound of raw material equals one pound (0.136 U.S. gal) of 100% biodiesel.	
Biosource Fuels, LLC	Michael Marquardt P.O. Box 639 Kenosha, WI 53141 (262) 859-2272 mikem@biosourcefuels.com	Proprietary multi-feedstock technology for the production of methyl esters and glycerol from all feedstocks including vegetable oils, animal fats, and recycled fats and oils. Process is continuous with biodiesel distillation, full co-product recovery, and fully automated plants with PLC or DCS controls.	Developed through three years of advanced research and development and integrated into a continuous 10 gph pilot plant and testing facility. A 10 mgy commercial facility is currently under design for startup in 2004. Strategic partnership with the Dupps Company for the manufacture and assembly of plants for clients throughout the world.	Vegetable oils, animal fats, and recycled fats and oils	No limit from zero to 100%.	No limit. Feedstocks with MIU in excess of 3% require a feedstock preconditioning process package.	Only required if MIU is in excess of 3% to remove the excess water.	\$0.35 to \$0.50 per gallon depending upon volume, utility costs, labor rates, equipment depreciation, and consumable price indexes.	A 10 mgy facility can be installed into a 100 ft. x 120 ft. building including office spaces, analytical laboratory, and process technology, excluding tank farm.	Dependent upon size. Ranges from \$1.50 for four mgy to \$0.65/gallon for 30 mgy facilities including glycerin recovery and refining units.	Assuming the plant siting studies and permits are in process, four months for engineering and design; six months for procurement and component fabrication; two months for assembly; and two months for startup and commissioning.	Biodiesel conforms to ASTM, EN, and DIN standards. Glycerin is 95% pure as a minimum; however 99.7% purity can be achieved if so desired by client. Other co-product is a dry fertilizer and can be either a potassium or sodium based.	Yield is dependent upon feedstock makeup, FFA content, glyceride assay, and MIU. Ranges from 7.5 lbs. for vegetable oils up to 8.25 lbs. for brown grease. Glycerin yield is dependent upon FFA content.	Process warranties include feedstock yield, product quality, and plant throughput. Additionally, equipment and installation warranties are provided.
BIOX Corporation	Tim Haig 125 Lakeshore Road East, Suite 200 Oakville, ONT, Canada L6J 1H3 (905) 337-4973 trhaig@bioxcorp.com	A patented biodiesel technology developed at the University of Toronto, capable of converting any lipid-based feedstock containing from zero to 30% FFA into biodiesel on a 1:1 yield.	One million liter (0.264 mgy) pilot plant operating since April 2001. A 16 mgy commercial plant is expected to be commissioned in third quarter, 2004.		Zero to 30%	Less than 2%	None		Minimum size is five mgy through 50 mgy and requires a 60 ft. x 150 ft. footprint. The technology is not modular.	Capital costs range from \$1.25 for two to six mgy, through \$1.00 for six to 10 mgy, and \$0.75 for larger than 10 mgy plants.	Six months	Biodiesel meets all existing standards including DIN and EN. Glycerin is greater than 99% pure. Other co-products are salts.	Yield is 7.3 lbs. of feedstock per one gallon of biodiesel.	The end user only pays the fee charge on the biodiesel produced by volume. BIOX does not intend to sell or license plants. The end user will own the biodiesel produced. The fee is approximately \$0.50 per gallon.
Crown Iron Works Company	Derek Masterson P.O. Box 1364 Minneapolis, MN 55440-1364 (651) 638-5443 dmasterson@crowiron.com	Continuous process for base catalyzed transesterification of neutral oil.	Commercial plant operating at 12 mgy; others in project engineering phase for up to 30 mgy to be operational in 2005.	Variable	Variable	Variable	Variable	Variable	Minimum size is five to 10 mgy with no limit to the maximum size.	Variable	Variable	Biodiesel meets ASTM standard. Glycerin is 99.7% pure. Other co-products include fatty material if present in feedstock.	Virtually 100%	Warranties are provided on capacity and utility and chemical consumption.
Energiea Biodiesel Technology	Mr. Herbert Prischink Industrie 1-7, A-3400 Klosterneuburg, Austria +43 2243 440 300 herbert.prischink@ energiea.at	Multi-feedstock continuous transesterification and esterification process. Optional pre-esterification module is especially suited for yellow grease. Skid mounted, modular construction with double redundancy on all moving parts. State-of-the-art computer automation allows for theoretical one-man operation (safety regulations permitting) and on-the-fly adjustment of variable feedstock.	Commercial stage with facilities in Austria (12 mgy), England (75 mgy), Spain (12 mgy), Australia (12 mgy), and Austria (45 mgy) will start early 2004.	Vegetable oils, used cooking oil, and animal fats	100%	3% 0.5% Water 0.5% Impurities 2% Unsaponifiables	Depends upon fat quality.	\$0.42 to \$0.93 per gallon depending upon volume, utility costs, labor rates, equipment depreciation, and consumable price indexes. (This cost includes \$0.05 to \$0.24 per gallon capital equipment depreciation expense depending upon plant capacity based on five-year depreciation.)	Minimum size is three mgy up to 75 mgy.	Costs are dependent upon FFA content and cost of infrastructure.	Containers ship eight months after signing of contract, plus four to six weeks of assembly and another six weeks for commissioning.	Biodiesel meets ASTM and EN 14214 standards. Glycerin is 80% pure. Other co-products include a potassium sulfate fertilizer.	100%	A 12-month warranty is provided. Maintenance contracts are optional.
Imperial Western Products, Inc.	Curtis Wright, P.E. 86600 Avenue 54 Coachella, CA 92236 (760) 398-0815 cwright@ imperialwesternproducts.com	Batch plant production of esters and glycerin using low temperature and pressure.	Commercial plant in operation for two years capable of producing 10 mgy.	Oils or yellow grease	40%	Less than 2%	Not required, but advised to filter and remove moisture.	Depends upon volume, but between 40 and 80 cents per gallon.	Plant size is 10 mgy and requires a 10,000 square foot footprint, excluding tank farm.	Costs are \$0.20 to \$0.50 per gallon.	One year	Biodiesel meets ASTM standards. Glycerin is greater than 90% pure.	Greater than 98%.	IWP is prepared to offer the technology developed and warranty to perform as it does at IWP facility.
Lurgi PSI, Inc.	Martin Kleber 1790 Kirby Parkway, Suite 300 Memphis, TN 38138 (901) 255-6434 mkleber@lurgipsi.com	Continuous transesterification process using patented reactors and glycerin systems.	Commercial scale since 1988; 2.5 mgy modular units; 10 mgy and larger are in an open air steel structure.		Zero to 20%		Yes	13.7 cents per gallon at 30 mgy capacity. (This value has been adjusted to include the glycerin co-product value estimated at \$0.225 per gallon credit.)	Minimum plant size 0.75 mgy up to 35 mgy. A 30 mgy plant requires a 40 ft. x 100 ft. footprint and a 2.5 mgy plant requires a 13 ft. x 40 ft. footprint.	Costs range from \$1 per gallon for two to six mgy, thru \$0.63 per gallon for six to 10 mgy, and \$0.26 per gallon for 10 mgy and larger.	Eight months for 2.5 mgy, and 13 months for 10 mgy.	Biodiesel meets ASTM and EN 14214 and DIN 51606 standards. Glycerin is 99.8% pure.	Differs from feedstock to feedstock. RDB soybean oil requires 100 lbs. of soybean oil to make 100 lbs. of methyl ester (100%).	Quality of biodiesel and glycerin, production capacity, consumption figures for chemicals, and energy and time schedule.
Pacific Biodiesel, Inc.	Robert King 285 Hukilike Street, B105 Kahului, Hawaii 96732 (808) 877-3144 bking@biodiesel.com	Efficient batch process biodiesel plant available in 400,000 gallon per year increments.	Three completed plants all in production.		Base plant 6%		None	Proprietary	Minimum plant size is 0.2 mgy with a maximum size of two mgy. Each million gallon production capacity requires 3,000 square feet, excluding tank farm.	Capital costs are \$1 per gallon.	Six months	Biodiesel meets ASTM and DIN 51606 standards. Glycerin is 50% pure.	Ten pounds of feedstock per one gallon of biodiesel.	Equipment warranty on plant for one year and on tanks and piping for five years.
Superior Process Technologies	Tim Maneely 2136 Ford Parkway #262 St. Paul, MN 55116 (651) 699-0758 tmaneely@ superiorprocesstech.com	Continuous processing plants for production of ASTM D6751-02 and DIN 51606 quality biodiesel from animal, vegetable, and recycled oil feedstocks. Process includes full recovery, purification, and recycle of excess methanol. Batch processing designs available for low capacity plants. Glycerin processing to 99.7% USP grade and biodiesel product distillation are both available if desired.	Engineering in process for two U.S. commercial plants utilizing yellow grease as feedstock.		Up to 30%	2% max	Depends on feedstock.	Depends on plant capacity.	Continuous process down to three mgy with no upper limit. Smaller plants will be batch facilities. Skid mounted units are available up to five mgy.	From \$1.00 to \$2.50 TIC for two to six mgy, \$0.75 to \$1.70 TIC for six to 10 mgy, and \$0.50 to \$1.30 TIC per gallon for 10 mgy and larger plants depending on feedstock and infrastructure requirements.	Six to 14 months if permits are in place.	Biodiesel meets ASTM 6751-02 and DIN 51606 standards. Glycerin is 80% pure as a minimum and increased processing can achieve 99.7% purity. Other products include an inorganic fertilizer.	Depends on feedstock.	Process and equipment warranties are supplied and are specific to customer requirements.

The responses shown in this table have been provided by the individual technology providers and/or obtained from open literature. Some responses have been abbreviated due to space constraints. Please contact technology providers directly for more detailed information and/or explanations of responses.