# RECENT DEVELOPMENT

## TECHNICAL AND LEGAL CONSIDERATIONS FOR BIO-FUEL

### I. INTRODUCTION

In 1964, E.F. Schumacher, the economic advisor to the British Coal Board, stated that "[t]here is no substitute for energy, the whole edifice of modern life is built upon it. Although energy can be bought and sold like any other commodity, it is not 'just another commodity,' but the precondition of all commodities, a basic factor equally with air, water, and earth."[1] This comment, originally made in 1964, is just as valid today as it was then. However, today's energy sector is confronted with challenges that were not present when Mr. Schumacher made his statement. These challenges include aging infrastructure, terrorism-related vulnerabilities inherent in the current geopolitical distribution of oil and natural gas supply, and the negative effects that global climate change may have on our environment.[2] In his 2006 State of Union address, President Bush suggested a new direction for America's energy policy, stating that "[k]eeping America competitive requires affordable energy. And here we have a serious problem: America is addicted to oil, which is often imported from unstable parts of the world . . . We must also change how we power our automobiles."[3]

Commentators note that "[t]he combination of the new war on terrorism, domestic economic pressures, and increasing tensions in the Middle East has heightened the concern of many legislators and the Bush Administration on the United States' reliance on foreign, and potentially

1. DANIEL YERGIN, THE PRIZE: THE EPIC QUEST FOR OIL, MONEY & POWER 559 (Simon & Schuster 1992).

2. THE NAT'L COMM'N ON ENERGY POLICY, ENDING THE ENERGY STALEMATE: A BIPARTISAN STRATEGY TO MEET AMERICA'S ENERGY CHALLENGES vi (2004) [hereinafter THE NAT'L COMM'N ON ENERGY POLICY], *available at* http://www.energycommission.org/ht/a/GetDocumentAction/i/1088.

3. George W. Bush, President of the United States, 2006 State of the Union Speech 6 (Jan. 31, 2006), *available at* http://www.whitehouse.gov/stateoftheunion/2006/print/index.html.

unreliable, sources of oil, a concern expressed as an energy security risk."[4] Furthermore, "America's demand for abundant and reliable supplies of energy to fuel its expanding economy will continue to grow."[5] According to the National Commission on Energy Policy:

> Recent trends in some key energy markets are troubling. Rapidly rising oil prices have drawn considerable attention over the last year . . . . Higher energy costs . . . are thought to be slowing economic growth. [T]he United States will require substantially increased quantities of electricity, natural gas, and transportation fuels over the next 20 years. The challenge of providing for continued demand growth is complicated by the need to expand the nation's production and use of energy in a manner compatible with emerging environmental and national security imperatives. . . . [N]o single technology, resource, or policy can solve all energy problems or meet all energy policy objectives. [M]eeting those objectives will require a portfolio of responses, some of them not yet developed or perhaps even known.[6]

Against the backdrop of this "energy security risk," many new technologies that could break this addiction to oil are in the development pipeline. The President spoke of researching more efficient batteries for hybrid and electric cars, hydrogen fuel cells, and ethanol.[7] Measures such as developing more efficient means of energy storage as well as alternate energy sources provide potential opportunities by which to diminish our addiction to foreign oil. The U.S. Department of Energy's Renewable Energy and Alternative Fuels Data Center reports eight alternative ways to power vehicles: biodiesel, electricity, ethanol, hydrogen, methanol, natural gas, propane, and p-series.[8] This Recent Development will focus on the technical and legal considerations of biodiesel.

## II. DESCRIPTION

Biodiesel is defined as the "variety of ester-based oxygenated fuels made from soybean oil, other vegetable oils, or animal fats."[9] Specifically,

> [b]iodiesel is the name of a clean burning alternative fuel, produced from domestic, renewable resources. Biodiesel contains no petroleum, but it can be blended at any level with petroleum

4. Tracy A. LeBeau, *Energy Security and Increasing North American Oil and Gas Production*, 16 NAT. RES. & ENV'T 193 (2002).

5. THE NAT'L COMM'N ON ENERGY POLICY, *supra* note 2, at 41.

6. *Id.*

7. Bush, *supra* note 3.

8. U.S. DEP'T OF ENERGY, ENERGY EFFICIENCY & RENEWABLE ENERGY, ALTERNATIVE FUEL DATA CENTER, http://www.eere.energy.gov/afdc/ (last visited Mar. 10, 2008).

9. ASS'N OF EQUIP. MFRS., NEW DIESEL FUELS: THEY ARE IN YOUR FUTURE FOR NONROAD EQUIPMENT 3 (2001), *available at* http://www.biodiesel.org/resources/reportsdatabase/reports/gen/20011101gen-314.pdf.

> diesel to create a biodiesel blend. It can be used in compression-ignition (diesel) engines with little or no modifications. Biodiesel is simple to use, biodegradable, nontoxic, and essentially free of sulfur and aromatics.[10]

To make biodiesel from vegetable oils or animal fats, glycerin is separated from the oil or fats in a process called transesterfication.[11] The separated oils and fats chemically react with either sodium hydroxide or a form of alcohol, typically methanol, resulting in fatty methyl esters, "the technical term for biodiesel," and the by-product glycerol.[12] "The simplified production formula is 100 pounds of oil or fat plus ten pounds of alcohol equals 100 pounds of biodiesel and 10 pounds of glycerol."[13] A simple rule of thumb is that 7.5 pounds of fat or oil results in approximately one gallon of biodiesel.[14] Biodiesel can be used at a 100% concentration; however, it is more common to mix the biodiesel with petroleum diesel.[15] In fact, "[t]he most common mixtures are B2 containing 2% biodiesel and B20 containing 20% biodiesel."[16]

## III. BENEFITS

Deborah Morrissett, Vice President of Regulatory Affairs at Daimler Chrysler, recently stated that "[b]iodiesel represents a huge opportunity to address some of our nation's toughest energy, environmental and economic challenges."[17] From an energy policy perspective, "[s]ince the late 1980s, the United States has pursued a policy of promoting alternatives to petroleum-based transportation fuels as a means of diminishing the nation's vulnerability to oil price shocks and supply disruptions . . . ."[18] While biodiesel is not a solution that will completely replace all petroleum fuels, it should be an important part of the nation's energy portfolio. This section will focus on biodiesel's benefits to energy security, the environment, and the United States.

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10. Nat'l Biodiesel Bd., Biodiesel Basics, http://www.biodiesel.org/resources/biodiesel_basics/ (last visited Mar. 10, 2008).

11. *Id.*

12. David Coltrain, Extension Assistant, Dep't of Agric. Econ., Kan. Coop. Dev. Ctr., Address at the Kansas State University Risk & Profit Conference: Biodiesel: Is It Worth Considering? 2 (Aug. 15–16, 2002), http://www.agmrc.org/NR/rdonlyres/513C6A14-28DE-4B54-A57E-EA7FE052E399/0/bdconsider.pdf.

13. *Id.*

14. *Id.* at 5.

15. *Id.* at 2.

16. *Id.*

17. Press Release, Nat'l Biodiesel Bd., Jeep® to Fuel Grand Cherokee CRD with B5 Biodiesel Blend at the Factory: Progress Continues on a National B20 Specification With Latest ASTM Vote 1 (July 27, 2006), *available at* http://www.biodiesel.org/resources/pressreleases/pas/20060727_jeepgrandcherokee.pdf.

18. THE NAT'L COMM'N ON ENERGY POLICY, *supra* note 2, at 70.

*A. Energy Security*[19]

Currently, global oil supply stands at approximately eighty-four million barrels of oil a day ("MBD").[20] Over the next twenty-five years, global oil demand is expected to grow at approximately 1.9% per year to approximately 119 MBD.[21] North America and the emerging economies of Asia, such as China and India, will account for the largest portion of this increased demand.[22] Currently, global oil supply is considerably strained because global reserve capacity is quickly diminishing. Furthermore, the majority of worldwide oil supplies are centered in regions that are politically or economically unstable. These regions experience various levels of internal strife, are often targeted by terrorist attacks, and sometimes demonstrate outright hostility toward U.S. interests.[23] As such, the United States will need to reduce its reliance on petroleum.

Approximately 67% of U.S. oil consumption is used in the transportation sector.[24] Of this, approximately thirty-seven billion gallons of diesel are used for on-road use each year.[25] Reducing demand in the transportation sector is a necessary component of any program to reduce reliance on imported petroleum.[26] While biodiesel is one part of a much broader effort to reduce overall petroleum usage, biodiesel and ethanol in particular are gaining momentum in the United States as alternative energy sources. According to the National Biodiesel Board, "[g]overnment and private fleets are increasingly turning to biodiesel, making it the fastest growing alternative fuel in America."[27] Furthermore, a study by the U.S. Department of Energy and U.S. Department of Agriculture found that for every unit of fossil energy needed to make biodiesel, 3.2 units of energy are gained.[28] Therefore, every gallon of biodiesel could potentially displace

19. *See generally High Cost of Crude—The New Currency of Foreign Policy: Hearing Before S. Comm. on Foreign Relations*, 109th Cong. (2005) (statement of R. James Woolsey, Vice President, Booz Allen Hamilton), *available at* http://foreign.senate.gov/testimony/2005/WoolseyTestimony051116.pdf (discussing the national security implications of increased reliance on alternative energy sources).

20. Energy Info. Admin., International Petroleum Monthly tbl.1.4 (Feb. 2008), http://www.eia.doe.gov/emeu/ipsr/t14.xls. "'Oil Supply' is defined as the production of crude oil (including lease condensate), natural gas plant liquids, and other liquids, and refinery processing gain (loss)." *Id.*; *see also* Energy Info. Admin., Appendix C: Glossary, http://www.eia.doe.gov/emeu/ipsr/appc.html (last visited Mar. 10, 2008).

21. ROBERT L. HIRSCH.ET AL., PEAKING OF WORLD OIL PRODUCTION: IMPACTS, MITIGATION, AND RISK MANAGEMENT 75 (2005), *available at* http://www.projectcensored.org/newsflash/The_Hirsch_Report_Proj_Cens.pdf.

22. *Id.*

23. THE NAT'L COMM'N ON ENERGY POLICY, *supra* note 2, at 1.

24. *See* NAT'L BIODIESEL BD., BIODIESEL IS PART OF THE SOLUTION TO DECREASE AMERICA'S DEPENDENCE ON FOREIGN OIL, http://www.biodiesel.org/pdf_files/fuelfactsheets/Energy_Security.pdf (last visited Mar. 10, 2008) [hereinafter BIODIESEL FACT SHEET].

25. *Id.*

26. *Id.*

27. *Id.*

28. JOHN SHEEHAN ET AL., NAT'L RENEWABLE ENERGY LAB., LIFE CYCLE INVENTORY OF

four gallons of imported petroleum.[29]

Biodiesel alone is not the solution to transportation energy needs in the United States. However, when considered as a part of a larger portfolio of options—including ethanol, electricity, and hydrogen—the United States could curb its reliance on imported petroleum through capitalizing on this resource.

*B. Environmental Benefits*

Air quality in major U.S. cities has on average improved over the last twenty years. However, a number of cities are still not in compliance with federal Clean Air Act ("CAA") standards.[30] Additionally, many cities with significant economic activity are starting to realize the danger posed by toxic air pollutants.[31] Biodiesel is a cleaner burning alternative fuel.[32] In fact:

> Biodiesel is the first and only alternative fuel to have a complete evaluation of emissions results and potential health effects submitted to the U.S. Environmental Protection Agency (EPA) under the Clean Air Act Section 211(b). These programs include the most stringent emissions testing protocols ever required by the EPA for certification of fuels or fuel additives. The data gathered complete the most thorough inventory of the environmental and human health effects that current technology will allow.[33]

With the exception of nitrogen oxide ("NOx"), emissions from engines running biodiesel are significantly reduced. While NOx emissions are slightly higher, the total ozone-forming potential of biodiesel is lower than 100% diesel.[34] Plus, this analysis does not assess the potential impact that use of biodiesel could have with regard to climate change. For example, biodiesel is derived primarily from plant feed stock, and as these plants grow, they are continually absorbing and removing carbon dioxide, a

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BIODIESEL AND PETROLEUM DIESEL FOR USE IN AN URBAN BUS v (1998), *available at* http://www.nrel.gov/docs/legosti/fy98/24089.pdf.

29. BIODIESEL FACT SHEET, *supra* note 24.

30. *See* Jack Caravanos, Successes and Challenges in Managing Urban Air Pollution: The New York City Experience 1 (2000) (unpublished manuscript), *available at* www.hunter.cuny.edu/rome-nyc/caravanos.doc.

31. *See, e.g.*, ANDREA L. CLEMENTS ET AL., THE CONTROL OF AIR TOXICS: TOXICOLOGY MOTIVATION AND HOUSTON IMPLICATIONS (2006), *available at* http://hydrology.rice.edu/ceve/fraser/FINAL%20MASTER.pdf (providing a detailed analysis of the state of air pollution in Houston and the various public health risks involved).

32. Press Release, Nat'l Biodiesel Bd., Biodiesel's Role in Improving Air Quality is Focus of Lung Association Forum (Sept. 8, 2006), http://www.biodiesel.org/resources/pressreleases/gen/20060908_airqualityforum_final_.pdf.

33. NAT'L BIODIESEL BD., BIODIESEL EMISSIONS, http://www.biodiesel.org/pdf_files/fuelfactsheets/emissions.pdf (last visited Mar. 10, 2008) [hereinafter EMISSIONS FACT SHEET].

34. *Id.*

known greenhouse gas, from the atmosphere through cellular respiration.[35] The following table highlights the differences in emissions between 100% biodiesel, a blend of 20% biodiesel, and regular diesel.

| **Average Biodiesel Emission Compared to Conventional Diesel[36]** | | |
|---|---|---|
| Emission Type | 100% Biodiesel | 20% Biodiesel |
| Total Unburned Hydrocarbons | -67% | -20% |
| Carbon Monoxide | -48% | -12% |
| Particulate Matter | -47% | -12% |
| Nitrogen Oxides | +10% | +2% to -2% |
| Sulfates | -100% | -20% |
| Polycylic Aromatic Hydrocarbons (PAH) | -80% | -13% |
| Nitrated PAH's | -90% | -50% |
| Ozone Potential of Speciated Hydrocarbons | -50% | -10% |

*C. Economics*

Two main issues frame the economic analysis of biodiesel. The first is the cost of widespread introduction of biodiesel into the U.S. transportation network. The second issue involves assessing the benefits to domestic and foreign farmers.

Full-scale implementation of biodiesel requires two things. First, the ability to turn biomass into biodiesel must be increased dramatically. This step would require the construction of a significant number of biodiesel production plants.[37] Second, the United States must be able to grow or import biomass feedstock. In other words, because feedstock is the most expensive part of the process, manufacturing plants will need to have reliable access to relatively low-cost feedstock.[38]

The necessary biomass feedstock, such as soybean, must be grown. This should have a direct positive impact on U.S. farmers. Additionally, "if just 1% biodiesel were blended with highway diesel . . . over 300

35. *See* John Pickrell, *Oceans Found to Absorb Half of All Man Made Carbon Dioxide*, NATIONAL GEOGRAPHIC NEWS (July 15, 2004), http://news.nationalgeographic.com/news/2004/07/0715_040715_oceancarbon.html.

36. *Id.*

37. Coltrain, *supra* note 12, at 3. "Currently, 17 plants in the U.S. are registered as biodiesel suppliers. These plants are scattered around the country because of the variety of feedstocks that are used in producing biodiesel. Dedicated production is estimated to be between 60 and 80 million gallons per year." *Id.*

38. *See id.* at 5.

million gallons of biodiesel would be required."[39] Approximately 194 million bushels of soybeans would be required to produce that much biodiesel.[40] This is based on the assumption that 7.3 pounds of soybeans are required to produce one gallon of biodiesel and that a bushel contains 11.3 pounds of soybeans.[41] This means that 3.9 billion bushels of soybeans would be required to achieve a 20% biodiesel mixture.[42] As the entire harvest of U.S. soybeans for 2004 was only 3,124 million bushels, the United States would need to import significant amounts of soybeans or other feedstock or create incentives to increase domestic feedstock production.[43] However, as opposed to petroleum imports, importing biomass feedstock could also benefit many developing countries, as well as the farmers in those countries producing the required feedstock.

## IV. LEGAL REQUIREMENTS AND INCENTIVES: THE ENERGY POLICY ACT OF 2005

On August 8, 2005, President Bush signed the Energy Policy Act of 2005 ("EPAct 2005"), which created new alternative energy requirements and incentives and expanded existing programs for biodiesel and other alternative fuel sources.[44] Several of these new requirements and programs are highlighted below.

### *A. Section 741: Clean School Bus Program*[45]

EPAct 2005 authorized the appropriation of $55 million for fiscal years 2006 and 2007 to fund: (1) the replacement of school buses with new alternative fuel powered buses; (2) the use of biodiesel or ultra-low sulfur diesel in new or existing buses; or (3) the installation of retrofit equipment on existing buses.[46] This program prioritized the replacement of pre-1977 buses, as well as the retrofitting of 1991 or later buses.[47] The Act provided funding for up to 100% of the retrofit technologies and installation costs, while replacement buses were funded at 50% or 25% depending on the emissions rating of the new bus.[48]

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39. ASS'N OF EQUIP. MFRS., *supra* note 9, at 4.

40. *Id.*

41. *Id.*

42. This figure is calculated by multiplying 20 times 194 million bushels.

43. MARK ASH & ERIK DOHLMAN, U.S. DEP'T OF AGRIC., OIL CROPS SITUATION AND OUTLOOK YEARBOOK 6 (2006), *available at* http://usda.mannlib.cornell.edu/usda/current/OCS-yearbook/OCS-yearbook-05-31-2006.pdf.

44. *See generally* Energy Policy Act of 2005, Pub. L. No. 109-58, 119 Stat. 594 (2005).

45. *See* 42 U.S.C. § 16091 (2005).

46. *Id.*

47. *Id.* § 16091(b)(2).

48. *Id.* § 16091(b)(4)–(5).

*B. Section 757: Biodiesel Engine Testing Program*[49]

This section directs the Department of Energy ("DOE") to work with diesel engine manufacturers and diesel fuel injector manufacturers to include biodiesel testing in advanced diesel engine and fuel system technology.[50] The program also requires the DOE to determine the impact of biodiesel from different sources on current and future emission control technologies, the impact of blending biodiesel with ultra-low sulfur diesel, and the impact of biodiesel on emissions warranty, in-use liability, and anti-tampering provisions.[51] EPAct 2005 has authorized the appropriation of $5 million per year for 2006-2010.[52]

*C. Section 932: Bioenergy Program*[53]

This provision requires the DOE to develop a program of research, development, demonstration, and commercial application for bioenergy, including biofuels, bioproducts, and crosscutting research and development in feedstocks.[54] The program's goals are to develop new and improved technologies including: "advanced processes that will enable the development of cost-effective bioproducts, including biofuels."[55] A maximum of $100 million is available for any single demonstration.[56] The Act also establishes a demonstration program to determine the feasibility of operating diesel electric power generators using biodiesel.[57]

*D. Section 941: Federal Research Incentives*[58]

Section 941 of EPAct 2005 amends the Biomass Research and Development Act of 2000 by specifically including among its objectives: (1) improved environmental quality; (2) promotion of rural economic development; (3) technologies and processes necessary for abundant commercial production of bio-based fuels at prices competitive with fossil fuels; and (4) high value bio-based products.[59] For these incentives, $200 million is appropriated for each fiscal year through 2015.[60]

49. *See* 42 U.S.C. § 16105 (2005).
50. *Id.* § 16105(a).
51. *Id.* § 16105(b).
52. *Id.* § 16105(d).
53. *See* 42 U.S.C. § 16232 (2005).
54. *Id.* § 16232(b).
55. *Id.* § 16232(c)(4).
56. *Id.* § 16232(d).
57. *Id.* § 16232(e).
58. 7 U.S.C. § 8601 (2005).
59. *Id.*
60. *Id.*

*E. Section 942: Production Incentives for Cellulosic Biofuels*[61]

The purpose of this incentive program is to accelerate deployment of biofuels and deliver the first billion gallons of annual cellulosic biofuels production by 2015.[62] "Cellulosic biofuels" refers to any fuel produced from cellulosic feedstocks.[63] Production incentives will be awarded on a per gallon basis through set payments per gallon produced, followed by a reverse auction system after annual production reaches 100 million gallons or three years.[64] The program has an appropriation of $250 million.[65]

*F. Section 944: Small Business Bioproduct Marketing and Certification Grants*[66]

The Secretary of Agriculture must now provide competitive grants for bio-based product marketing and certification purposes.[67] Eligible entities are any manufacturer of bio-based products, with a preference for companies with fewer than 50 employees.[68] Grants can be used for the marketing of bio-based products and the certification of bio-based products to qualify for labeling under the Farm Security and Rural Investment Act or other standards.[69] The maximum grant is $100,000 with equal matching funds required by the applicant.[70]

*G. Section 1341: Alternative Motor Vehicle Credit*[71]

This provision establishes a tax credit for fuel cell, lean burn, hybrid, and alternative fuel vehicles.[72] The amount of the credit depends on the technology, vehicle size, and other factors such as fuel economy.[73] One incentive provides for a tax credit equal to up to 80% of the cost difference between an alternative fuel vehicle and that of a gasoline or diesel operated vehicle.[74] The term "alternative fuel" is defined to include compressed natural gas, liquefied natural gas, liquefied petroleum gas, hydrogen, and any liquid whose volume consists of at least 85% methanol.[75] The credit

61. 42 U.S.C. § 16251 (2005).
62. *Id.* § 16251(a).
63. *Id.* § 16251(b).
64. *Id.* § 16251(c).
65. *Id.* § 16251(f).
66. 42 U.S.C. § 16253 (2005).
67. *Id.* § 16253(a).
68. *Id.* § 16253(b).
69. *Id.* § 16253(c).
70. *Id.* § 16253(e).
71. 26 U.S.C. § 30B (2005).
72. *Id.* § 30B(a).
73. *Id.* § 30B(b).
74. *Id.* § 30B(e).
75. *Id.*

for alternative fuel vehicles will expire in 2011.[76]

*H. Section 1344: Excise Tax Provisions and Income Tax Credit for Biodiesel*[77]

This legislation extends the tax credit for biodiesel producers established in the American Jobs Creation Act of 2004 through 2008.[78] This provision provides for tax credits of $0.50 per gallon of waste-grease biodiesel and $1.00 per gallon of agri-biodiesel.[79] If the fuel is used in a mixture, the credit amounts to one cent per percentage point of agri-biodiesel or one-half cent per percentage point of waste-grease biodiesel.[80]

*I. Section 1345: Small Agri-Biodiesel Producer Credit*[81]

This legislation provides for an income tax credit for small biodiesel producers.[82] The biodiesel fuels credit for a taxable year is equal to the sum of: (1) the biodiesel mixture credit, plus (2) the biodiesel credit, plus (3) in the case of an eligible small agri-biodiesel producer, the small agri-biodiesel producer credit.[83] The small agri-biodiesel producer credit is ten cents for each gallon of qualified agri-biodiesel produced.[84] However, the incentive only applies to "qualified agri-biodiesel production," which is limited to fifteen million gallons a year from each small producer.[85]

*J. Section 1501: Renewable Content of Gasoline/Fuel Standards Program*[86]

This provision requires the Environmental Protection Agency ("EPA") to create regulations to ensure that gasoline sold or introduced into U.S. commerce—except for noncontiguous States and territories—contains, on an annual average, the applicable volume of renewable fuel.[87] Under this program, the term "renewable fuel" emphasizes both biodiesel and ethanol gasoline.[88]

76. 26 U.S.C. § 30B(j).

77. 26 U.S.C. § 40A (2005).

78. DEP'T OF TREASURY, INTERNAL REVENUE SERV., INTERNAL REVENUE BULLETIN NO. 2005-2 (2005), *available at* http://www.irs.gov/pub/irs-irbs/irb05-02.pdf.

79. 26 U.S.C. § 40A.

80. *Id.* § 40(A)(b).

81. *Id.* § 40A(a).

82. *Id* § 40A(b)(5).

83. *Id.* § 40A(a).

84. 26 U.S.C. § 40A(b(5).

85. *Id.*

86. *See* 42 U.S.C. § 7545 (2005).

87. *Id.*

88. *Id.*

*K. State Laws and Incentives*

Nearly all states offer incentive programs or regulations regarding alternative fuel vehicles that mirror the federal mandates and programs.[89] Notably, many states have programs and requirements that focus specifically on the regulation and use of biofuels.[90] The following chart provides a broad overview of some of these programs and requirements.[91]

| **Program/Requirement** | **States** |
|---|---|
| Biofuel Tax Credits, Reductions or Exemptions | AR, AZ, CA, FL, HI, IA, ID, IL, IN, KS, KY, LA, MD, ME, MS, MT, NC, ND, NE, NM, OH, OK, RI, SC, SD, TX, WA |
| Biofuel Rebates, Loan or Grant Programs | DE, FL, IA, IL,IN, ND, NJ, TN, VA |
| Biofuel Specification Requirements | AZ, CA, GA, HI, IA, IN, LA, MN, TN, WA |
| Biofuel Use or Procurement Requirements or Incentives | CA, HI, IA, ID, IL, IN, KS, KY, MD, MN, MO, NM, NY, OH, SD, VA, WA, WI |
| Biofuel Committee, Task Force or Plan | MN, MS, NH, PA, TN, VT, WI |

## V. PROBLEMS

There are several problems that must be addressed before biodiesel becomes a major fuel in the U.S. transportation sector. As discussed above, a 20% biodiesel mixture would require more soybeans than currently produced in the United States.[92] Although biodiesel can be produced using any feedstock, production of biodiesel would require a large amount of farm land. Additionally, the feedstock needs to be relatively inexpensive to allow biodiesel to be competitive with traditional diesel.

Biodiesel also presents several technical barriers. For example, biodiesel softens and degrades certain types of elastomers and natural rubber compounds over time, and the use of high-biodiesel content blends

89. ICF CONSULTING, U.S. ENVTL. PROT. AGENCY, STATE INCENTIVES FOR CLEANER TRANSPORTATION TECHNOLOGIES (2001), *available at* http://www.epa.gov/otaq/market/rpt914.pdf.

90. *See generally* Alternative Fuels & Advanced Vehicles Data Ctr., U.S. Dep't of Energy, All State Incentives and Laws, http://www.eere.energy.gov/afdc/progs/all_state_summary.php/ afdc/0 (last visited Mar. 10, 2008).

91. The chart provides data according to information collected by the U.S. Department of Energy's Alternative Fuels and Advanced Vehicles Data Center. *See id.*

92. *See supra* notes 39–43 and accompanying text.

can attack fuel hoses and fuel pump seals.[93] However, most new diesel vehicles have switched to a different rubber compound that does not degrade or soften.[94] The problem now lies with older diesel vehicles that will require some modifications, such as replacing the rubber components that come in contact with fuel, in order to run with biodiesel and avoid the problems noted above.

Another problem is that cold weather can cloud and gel biodiesel.[95] While this is common to all diesel fuels, a diesel mixture containing 20% biodiesel will gel at a temperature of approximately 3º to 5º Fahrenheit higher than with conventional diesel.[96] Additionally, biodiesel fuel is less stable than conventional diesel.[97] This means that biodiesel has a shorter shelf life than conventional diesel because "[t]he high oxygenate content of biodiesel makes it much more susceptible to oxidation breakdown."[98] The gummy residue and varnish that result can lead to filter plugging or injector deposits.[99] However, various anti-oxidation additives that address some of the stability concerns are under development.[100]

While such serious challenges to merging biodiesel into the diesel fuel supply remain, they do not necessarily present insurmountable barriers that would preclude the introduction of biodiesel into the broader diesel market.

## VI. CONCLUSION

Biodiesel is not a fuel that will, or can, end our addiction to oil. However, if used as part of a broader program by the U.S. to develop a significant renewable transportation portfolio, biodiesel could significantly reduce our dependence on petroleum. Because biodiesel is a substitute or extender for traditional petroleum diesel, the same infrastructure used to transport and dispense regular petroleum diesel could soon be used for biodiesel.[101]

A final compelling characteristic of biodiesel is that it presents significant environmental benefits when compared to traditional diesel. In essence, while faced with technical barriers, biodiesel is a cleaner, homegrown fuel that can fit seamlessly into the current diesel infrastructure while simultaneously helping U.S. farmers. The development and use of biodiesel could finally realize the dream of Dr. Rudolf Diesel, who

93. ASS'N OF EQUIP. MFRS., *supra* note 9.

94. *See* Soy Gold Bio Diesel, http://www.soygold.com/products/Fuels/fuels_intro.htm (last visited Mar. 10, 2008).

95. ASS'N OF EQUIP. MFRS., *supra* note 9.

96. *Id.*

97. *Id.*

98. *Id.*

99. *Id.*

100. ASS'N OF EQUIP. MFRS., *supra* note 9.

101. *See id.*

developed the first diesel engine to run on vegetable oil. [102]

*John Herbig**

102. Monsanto, Biofuels, http://www.monsanto.co.uk/biofuels/071202.html (last visited Mar 10, 2008).

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