Bioenergy: Fueling the Future?

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I. INTRODUCTION

President George W. Bush declared in his 2006 State of the Union address that "America is addicted to oil."[1] This is not new information to many Americans. Oil and gas are used daily to heat our homes, fuel our cars, and so on. In fact, the U.S. Energy Information Administration reports the average "amount of fuel consumed in family vehicles in the United States each year is enough to cover a regulation-size football field to a depth of about 40 miles."[2] The problem is that America's oil and gas habit cannot be sufficiently supported internally. Rather, America feeds it addiction with oil imported from foreign countries.[3]

Reports of America's dependence on foreign oil can be seen almost daily in the news, and this dependence is also evident in the ever fluctuating, and often skyrocketing, gas prices across the nation. Some have concerns that this dependence could drastically affect the economy and national security of the U.S. if no changes are made.[4] However, what is not explained by news reporters or fully understood among many Americans is just how dependent the U.S. really is on foreign suppliers. Nor do many news reporters inform the general public about the efforts the U.S. is making to combat this dependence and whether these efforts will really work.

Thus, the purpose of this note is to answer the looming questions that many Americans might have when pondering the issue of U.S. foreign oil dependence and how they are going to be able to afford to live if something is not done to relieve the problem. First, this note will give some background information and statistics on the U.S.'s dependence on foreign oil. This will lead to a discussion of recent legislation at both the federal and state level that has been approved to promote the development of alternative energy sources, specifically biofuels. Next, information will be given defining bioenergy and its many forms, as well as the advantages and disadvantages of this type of energy. The note will then go on to discuss predictions regarding the potential for growth of bioenergy

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1. President George W. Bush, State of the Union Address (Jan. 31, 2006) (transcript available at http://www.c-span.org/executive/transcript.asp?cat=current_event&code=bush_admin&year2006) [hereinafter Bush].

2. Ad Hoc Comm. on Envtl. Stewardship, *Green Facts for the U.S. & the World at Large,* http://www.environment.emory.edu/green/world.shtml (last visited Jun. 12, 2007).

3. Bush, *supra* note 1.

4. *See* Nat'l Resources Def. Council, *Safe, Strong and Secure: Reducing American's Oil Dependence*, http://www.nrdc.org/air/transportation/aoilpolicy2.asp (last visited Jun. 12, 2007) [hereinafter NRDC].

use worldwide and in the U.S. Finally, the note will conclude with a short evaluation of the U.S.'s plan to make bioenergy fuels the fuel of the future, and if this plan will be successful.

II. U.S. DEPENDENCE ON FOREIGN OIL

Each day, the U.S. consumes roughly 20 million barrels of oil.[5] Over half of this (more than 10 million barrels) is imported.[6] Importation of this oil comes at a very high price.

The Natural Resources Defense Council reports that America spends "more than $200,000 per minute -- $13 million per hour -- on foreign oil, and more than $25 billion a year on Persian Gulf imports alone."[7] In fact, "[e]very day the U.S. pays out $390 million for foreign oil, with half of every dollar going to OPEC [Organization of Petroleum Exporting Countries] and a quarter to the Persian Gulf."[8] Some of this money might make it back to the U.S. economy; however, it is more likely that any money paid out to OPEC will not be reinvested in the U.S.[9] It is projected that in 2025 the U.S. will consume forty-four percent, or 28.3 million barrels, more oil per day than is consumed right now, "with domestic production meeting a mere 30 percent of that need."[10] Thus, sixty percent of U.S. oil will need to be imported.[11]

One might think the easiest way to avoid this dependence is for the U.S. to begin drilling in more places within its own borders, such as the Arctic National Wildlife Refuge. This, however, would not be a worthwhile nor very prosperous option.[12] The U.S. has just three percent of the oil reserves worldwide; meanwhile, the Middle East countries hold two-thirds of the world's oil reserves.[13] Even if drilling were to begin in the Arctic National Wildlife Refuge,

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5. Nat'l Biodiesel Bd., *Biodiesel and Energy Security*, *available at* www.biodiesel.org/pdf_files/fuelfactsheets/Energy_Security.pdf [hereinafter NBB].

6. *Id.*

7. NRDC, *supra* note 4; *see also* Iowa Corn, *Ethanol Facts*, http://www.iowacorn.org/ethanol/ethanol_3a.html (last visited Jun. 12, 2007) (reporting the U.S. spends approximately $50 billion every year to protect the importation of Mideast oil with military forces) [hereinafter Iowa Corn, *Facts*].

8. NRDC, *supra* note 4.

9. *Id.*

10. *Id.*

11. NBB, *supra* note 5 (reporting the U.S. Department of Energy projects that by 2025, the U.S. will import about 60% of all petroleum consumed).

12. *See* NRDC, *supra* note 4.

13. *Id* (citing Jad Mouawad, *Irrelevant? OPEC Is Sitting Pretty*, N.Y. TIMES, Oct. 3, 2004, at 4).

this would only increase the U.S. reserves by "less than one-third of one percent."[14]

This lack of oil supply for the ever increasing demand is not only a problem for the U.S., but for many other countries worldwide.[15] The world uses about "12 billion more barrels [of oil] per year than it finds."[16] This problem is not likely to find a resolution anytime soon. In the next 25 years, it is likely that oil consumption by industrializing nations will double, from "15 to 32 million barrels a day," making the projected world demand for oil 118 million barrels per day in the year 2025.[17] The global oil output will need to expand by more than 40 million barrels, or 50%, per day between 2002 and 2025 to meet this need.[18] This increasing demand and lack of supply will only further the competition between the U.S. and other countries for the oil available for export, and will continue to mean "record high crude prices and the threat of more skyrocketing costs."[19]

These high oil prices are already being felt by consumers with more expensive goods and services at the gas pump. Plus, the recent jumps in oil prices have reduced "15 percent of our economy's growth since the second World War, resulting in $1.2 trillion in direct losses."[20] In fact, with the loss of jobs, output, and tax revenues, the total economic penalty for U.S. foreign oil dependence is estimated at "between $297 and $305 billion annually."[21]

Obviously, something needs to be done or the U.S. will be in an even worse position in the future than it is right now. This leads us to the following question: what is being done to help relieve the United States of its dependence on foreign oil?

III. WHAT IS BEING DONE TO RELIEVE THE UNITED STATES OF THIS DEPENDENCE?

The U.S.'s dependence on foreign oil is overwhelming, and it is apparent the U.S. needs to develop a sustainable energy source within its own borders. One way which has been identified to achieve this is through the development and use of bioenergy—and lawmakers at both the state and federal level are taking note.

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14. *Id.*
15. *See id.*
16. *Id.*
17. *Id.*
18. *Id.*
19. *Id.*
20. *Id.*
21. *Id.*

A. *An Overview of Recent Legislation Promoting Alternative Energy Development and Use: Specifically Bioenergy*

Over the years, lawmakers have been attempting to help relieve foreign oil dependence and promote a cleaner environment through various energy saving, environment friendly laws. However, the momentum of these efforts has increased significantly due to the combination of "high energy prices, concerns over the geopolitical ramifications of the country's heavy reliance on foreign oil, and a crystallizing view that renewable energy technologies can offer new avenues for economic stimulus."[22]

On the federal level, in 2002, the Farm Security and Rural Development Act was the first farm bill to include an energy title with incentives for biomass use and production.[23] Then in August of 2005, by a 74 to 26 vote in the Senate and a 275 to 156 vote in the House of Representatives, Congress passed what has been touted as the most comprehensive energy bill since 1995—the Energy Policy Act ("EPAct") of 2005.[24] Plus, President Bush proposed an Advanced Energy Initiative in his 2006 State of the Union Address, calling for a 22 percent increase in spending on clean energy research technology at the Department of Energy.[25]

On the state level, some states, such as Minnesota, have implemented new laws to help with the development and use of bioenergy within their state which will likely set an example for other states to follow.[26] Plus, the benefits of EPAct can already be seen in states such as Iowa.[27]

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22. Envlt. & Energy Study Inst., *2005 Year in Review, U.S. Biomass Energy Policy*, Jan. 4, 2006, http://www.renewableenergyaccess.com/rea/news/story?id=41189 [hereinafter Envtl. & Energy Study Inst.].

23. *Id.*

24. Energy Policy Act of 2005, Pub. L. No. 109-58 §§ 1300-1364, 119 Stat. 594, 986-1060 (2005) (codified as amended in scattered sections of 26 U.S.C.); *House, Senate Approve Energy Policy Act of 2005*, ALTERNATIVE TRANSP. FUELS TODAY, Aug. 1, 2005, *available at* 2005 WLNR 12165944; *see* Biomass Res. and Dev. Initiative, *Biomass Provisions in the Energy Policy Act of 2005*, (Sept. 2005), http://www.brdisolutions.com/Newsletters/sept_2005/default.html [hereinafter Biomass Initiative] (outlining the numerous incentives for the energy industry).

25. Bush, *supra* note 1.

26. *See* Pacific Biofuel, *News from the National Biodiesel Board: Retail Biodiesel Now Available in Twin Cities*, Aug. 2, 2004, http://www.pacfuel.com/newsarchives.htm [hereinafter Pacific Biofuel].

27. *See, e.g.*, AGRI NEWS, *Work to Begin on Massive Biodiesel Plant in Northern Iowa*, Aug. 10, 2005, http://webstar.postbulletin.com/agrinews/283971271149995.bsp [hereinafter *Massive Biodiesel Plant*].

1. *Federal Level: Selected Summary of EPAct 2005 Bioenergy Provisions*

a. *Tax Credit*

EPAct offers various federal tax credits starting January 1, 2006.[28] For example, consumers and businesses will receive a tax credit "for purchasing fuel-efficient hybrid-electric vehicles and energy-efficient appliances and products."[29] Many consumers might also be eligible for "state tax incentives for energy-efficient homes, vehicles and [other] equipment."[30] Additionally, small producers of biodiesel and ethanol will get a "10 cent per gallon tax credit for up to 15 million gallons of agri-biodiesel produced" through 2008.[31] These small producers were once limited to producing only 30 million gallons of their respective biofuel; however, EPAct 2005 increases this production capacity to 60 million gallons.[32] Plus, EPAct establishes a 30% tax credit up to $30,000 through the end of 2010 for the cost of fueling stations installing clean-fuel refueling equipment.[33]

b. *Renewable Fuel Standard*

EPAct includes a renewable fuel standard (RFS) that all gas sold in the U.S. must contain four billion gallons of biofuels by 2006.[34] To think of it differently, this RFS means that 2.78 percent of gas sold in the U.S. in 2006 must be a

28. U.S. Dep't of Energy, *The Energy Policy Act of 2005: What the Energy Bill Means to You*, http://www.energy.gov/taxbreaks.htm (last visited Jun. 12, 2007) [hereinafter DOE, *What the Energy Bill Means to You*]; *see generally* Energy Policy Act of 2005, Pub. L. No. 109-58 §§ 1300-1364, 119 Stat. 594, 986-1060 (2005).

29. DOE, *What the Energy Bill Means to You*, *supra* note 28; *see also* Energy Policy Act of 2005, Pub. L. No. 109-58 §§ 943, 1331, 1334, 119 Stat. 594, 880, 1030, 1038, 1042 (2005).

30. DOE, *What the Energy Bill Means to You*, *supra* note 28.

31. DOE, *What the Energy Bill Means to You*, *supra* note 28; *see* Energy Policy Act of 2005, 119 Stat. 594, 1053 (2005).

32. DOE, *What the Energy Bill Means to You*, *supra* note 28; Energy Policy Act of 2005, 119 Stat. 594, 1056 (2005); *House, Senate Approve Energy Policy Act of 2005*, ALTERNATIVE TRANS. FUELS TODAY, Aug. 1, 2005, *available at* 2005 WLNR 12165944.

33. Energy Policy Act of 2005, 119 Stat. 594, 1049-51 (2005); *House, Senate Approve Energy Policy Act of 2005*, ALTERNATIVE TRANS. FUELS TODAY, Aug. 1, 2005, *available at* 2005 WLNR 12165944; D.O.E., *What the Energy Bill Means to You*, *supra* note 28.

34. Biomass Initiative, *supra* note 24; *U.S. Ethanol Industry Surpasses First Year Goal of RFS*, ALTERNATIVE TRANSP. FUELS TODAY, Nov. 30, 2005, *available at* 2005 WLNR 19704595; *see* Energy Policy Act of 2005, Pub. L. No. 109-58, sec. 1501(a)(2), §211(o)(2)(B)(i), 119 Stat. 594, 1069 (2005).

renewable fuel.[35] This RFS requirement nearly doubles by the year 2012, requiring 8.0 billion gallons of renewable fuel.[36]

There has been skepticism regarding whether the biofuel, particularly ethanol, industry would be able to meet this goal, but the Energy Information Administration reports that this goal will likely be met.[37] In September 2005, ethanol production was 261,000 barrels per day, which was 35,000 barrels per day higher than September 2004, and 1000 barrels per day higher than August 2005.[38] If these reports are any indication, the requirement of four billion gallons of biofuel in 2006 and 7.5 billion gallons of biofuel in 2012 should be easily reached.

EPAct 2005 further provides that "one gallon of cellulosic . . . or waste-derived ethanol will be counted as 2.5 gallons."[39] Yet, after 2012 this 2.5-to-one ratio will not apply, and the RFS will "require a minimum of 250 million gallons of cellulosic biomass fuels."[40]

c. *Increased Funding, Research, and Development for Bioenergy*

EPAct has various provisions promoting the increase in development and use of bioenergy. Most of these provisions are "aimed at improving biomass technologies and increasing the amount of biopower, biofuels, and bioproducts used in the U.S."[41] For example, there are provisions providing for loan guarantee programs and funding.[42] These programs ensure money for the development of cellulosic biofuel facilities, facilities for converting municipal solid waste into ethanol, and integrated biorefineries.[43] There are also grants available. These

35. *EPA Issues New Domestic Renewable Fuel Standards*, ALTERNATIVE TRANSP. FUELS TODAY, Jan. 4, 2006, *available at* 2006 WLNR 320639.

36. Energy Policy Act of 2005, Pub. L. No. 109-58, sec. 1501(a)(2), §211(o)(2)(B)(i), 119 Stat. 594, 1069 (2005); Biomass Initiative, *supra* note 24.

37. *See U.S. Ethanol Industry Surpasses First Year Goal of RFS*, ALTERNATIVE TRANSP. FUELS TODAY, Nov. 30, 2005, *available at* 2005 WLNR 19704595.

38. *Id.*

39. Envtl. & Energy Study Inst., *supra* note 22; Energy Policy Act of 2005, Pub. L. No. 109-58 sec. 1501, § 211(o)(4), 119 Stat. 594, 1071 (2005); *see President Bush Signs Energy Bill into Law*, ALTERNATIVE TRANSP. FUELS TODAY, Aug. 10, 2005, *available at* 2005 WLNR 12677280 [hereinafter *President Bush Signs Energy Bill*].

40. Envtl. & Energy Study Inst., *supra* note 22; *see* Energy Policy Act of 2005, Pub. L. No. 109-58, sec. 1501, § 211(o)(2)(B)(iii), 119 Stat. 594, 1070 (2005).

41. Biomass Initiative, *supra* note 24; *see* Energy Policy Act of 2005, Pub. L. No. 109-58, 119 Stat. 594, 870-72 (2005).

42. *See President Bush Signs Energy Bill*, *supra* note 39.

43. *See* Energy Policy Act of 2005, Pub. L. No. 109-58, § 932, 942, 1510, 1512, 119 Stat. 594 870-72, 878-80, 1085-86, 1088-89 (2005); *President Bush Signs Energy Bill*, *supra* note 39; Biomass Initiative, *supra* note 24; Envlt. & Energy Study Inst., *supra* note 22.

grants are to be used for "bioproduct marketing, demonstrations, clean school buses, and the production of ethanol."[44] For example, grants can be awarded to programs that work to replace or retrofit school buses with the capability to run on biodiesel or ethanol.[45] There is also a provision increasing the amount of funding from $54 million to $200 million for projects distributed through the National Biomass Research and Development Initiative.[46] These provisions will help give biomass renewable energy projects a step-up and opportunity to compete in the market.

EPAct calls for projects that address the production of hydrogen from biomass and biofuels, renewable energy, and bioenergy.[47] Plus, the Department of Energy is to (1) conduct projects that look at renewable energy technologies that are to help make the cogeneration of hydrogen and electricity happen; (2) create a program for bioenergy with the National Science Foundation which will help integrate bioenergy research and development; and (3) fund projects that identify best alternative resource technology and test biodiesel in engines.[48]

d. *Education*

The Environmental Protection Agency ("EPA"), U.S. Department of Agriculture ("USDA"), U.S. Department of Energy ("DOE"), National Science Foundation, and others, are all on board to help make the growth and use of bioenergy in the U.S. a reality.[49] To make this happen, the citizens of the U.S. will need to be educated about bioenergy. Thus, EPAct requires biomass technology demonstrations.[50]

The EPA will establish an "Advanced Biofuel Technologies Program" to demonstrate advanced technologies for the production of alternative fuels.[51] Similarly, the DOE is to create programs that "demonstrate renewable technologies in

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44. Biomass Initiative, *supra* note 34; *see also* Energy Policy Act of 2005, Pub. L. No. 109-58, §741, 944-47, 119 Stat. 594, 821-24, 881-83 (2005).

45. *See* EPA, Clean School Bus USA, Grants & Funding, http://www.epa.gov/otaq/schoolbus/funding.htm (last visited Jun. 12, 2007); *see also* Biomass Initiative, *supra* note 24; *see e.g.* Project Greenfleet, How to Participate: Frequently Asked Questions, http://www.projectgreenfleet.org/participate/faq.html (last visited Jun. 12, 2007).

46. Biomass Initiative, *supra* note 24; *see* Energy Policy Act of 2005, Pub. L. No. 09-58, sec. 941(g), § 310(b), 119 Stat. 594, 878 (2005).

47. Biomass Initiative, *supra* note 24; *see also* Energy Policy Act of 2005, Pub. L. No. 109-58, §§ 932-33, 119 Stat. 594, 870-72 (2005).

48. *See* Biomass Initiative, *supra* note 24.

49. Biomass Initiative, *supra* note 34 (stating that these agencies are to file assessments to Congress); *see also* Energy Policy Act of 2005 at § 1514(a).

50. Biomass Initiative, *supra* note 24.

51. *Id.*

buildings, hydrogen reformed from agricultural fields, and distributed generation using renewable sources."[52] Plus, the USDA is to have a outreach program that teaches people about biobased fuels and products.[53]

2. *State Examples of Bioenergy Legislation*

Some say it is easier to create and implement biomass programs on the state level.[54] Thus, the states have been following the federal government's lead, and making policies of their own to promote the production and use of bioenergy.[55] For example, in 2002, Minnesota was the first state to pass a law that required two percent biodiesel in almost all diesel fuel and ten percent ethanol in almost all gasoline by July 2005.[56] Despite opposition from automakers and oil companies, the ethanol requirement will double to twenty percent by 2013.[57] To make this happen, Minnesota has more E-85 stations available for consumers than the rest of the U.S.[58] Many states have followed Minnesota's lead. California, Ohio, Hawaii, Washington, and Montana have also passed laws that either require biofuels be used, or to establish a renewable fuel standard.[59] Also, in an effort to compete with Minnesota, Iowa is working to make more E-85 stations available across the state.[60]

Many states are also providing biomass incentives, in the form of tax credits and funding, which will help create market demand and/or assist biofuel producers in getting established.[61] In Oklahoma, a tax credit of twenty cents per gallon of biodiesel produced is given for the first five years, with a maximum yearly payment of $5 million.[62] While in North Dakota, laws have been passed providing millions of dollars for the construction or expansion of new and existing ethanol and biodiesel plants in the state, in addition to, tax credits on retail sales of biodiesel and ethanol.[63] Plus, just like Minnesota, the state of Washington has passed a law that requires at least 2% of gasoline sales to be composed of

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52. *Id.*
53. *Id.*
54. Envtl. & Energy Study Inst., *supra* note 22.
55. *See id.*
56. Pacific Biofuel, *supra* note 26.
57. *Ag Secretary Calls for More Access to E-85 Fuel*, DAILY NONPAREIL, Sept. 16, 2005, at B1 [hereinafter *Ag. Secretary Calls for More Access to E-85 Fuel*].
58. *Id.*
59. Envtl. and Energy Study Inst., *supra* note 22.
60. *See Ag Secretary Calls for More Access to E-85 Fuel*, *supra* note 57.
61. *See* Envtl. & Energy Study Inst., *supra* note 22.
62. *Id.*
63. *Id.*

ethanol by the year 2008, with the potential for the mandate to rise to 10% if the state can produce enough fuel crops.[64]

However, while these new laws seem to be a great idea in theory, some have experienced problems in implementation. For example, Minnesota's law requiring all biodiesel to contain a 2% blend of biodiesel has had some glitches.[65] Since the 2% mandate was enacted in September 2005, Minnesota has had various "complaints of clogged fuel filters and fuel that [does] not meet specifications."[66] In order to increase quality control measures and ensure high-grade biofuel, at least three waivers have been issued by the Minnesota Department of Commerce to allow for the off-spec fuel.[67] The National Biodiesel Board and Minnesota Biodiesel Council are constantly working to formulate and implement quality control measures that will ensure high-grade biodiesel is being used.[68] Given the hurdles Minnesota has faced, it is likely other states with similar laws may experience some of the same difficulties.

These are just a few examples of the biofuel policies that are being passed and implemented on the state level. This new law-making is only just beginning. Some states have yet to implement any biofuel policy. Plus, any state with a policy in place will likely need to pass follow-up laws and/or guidelines to ensure the initial law is effective.

3. *EPAct in Iowa*

Iowa is the nation's leading corn producer; thus, it is only natural that Iowa is also the home of the majority of ethanol production in the U.S.[69] As of August 2006, the U.S. had over 140 ethanol plants operating or being constructed.[70] Iowa alone is the home of twenty percent of these plants with "27 plants currently processing corn, mostly for ethanol, and as many more [are] either under construction, planned, or proposed."[71] With the completion of all of

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64. Hal Bernton, *Ethanol Demand Turns Corn Into A Growing Cash Crop*, SEATTLE TIMES, Oct. 15, 2006, *available at* 2006 WLNR 17876266 [hereinafter Bernton].

65. *See Biodiesel Leaders Request Enhanced QC Measures in MN*, ALTERNATIVE TRANS. FUELS TODAY, Jan. 19, 2006, *available at* 2006 WLNR 1141635.

66. *Minnesota Issues Third Biodiesel Waiver*, GLOBAL REFINING & FUELS REPORT, Jan. 18, 2006, *available at* 2006 WLNR 1302376 [hereinafter *Minnesota Issues*].

67. *Id.*

68. *Id.*

69. David Swenson & Liesl Eathington, *Determining the Regional Economic Values of Ethanol Production in Iowa Considering Different Levels of Local Investment*, July 2006, at 2, *available at* http://www.valuechains.org/bewg/Documents/eth_full0706.pdf [hereinafter Swenson & Eathington].

70. Bernton, *supra* note 64.

71. Swenson & Eathington, *supra* note 69.

these plants, Iowa's ethanol production will increase from 1.3 billion gallons to 3.8 billion gallons.[72]

A similar production increase is also true for biodiesel. Previously, the state of Iowa produced around 25 million gallons of biodiesel per year.[73] This number will soon increase to about 50 million gallons per year with the addition of two more biodiesel plants, making four in the state.[74] In fact, Iowa Falls, Iowa, is the home of the world's largest biodiesel plant, owned by Cargill, Inc.[75] Using soybeans from area farmers, this plant is expected to produce 37.5 million gallons of fuel per year.[76]

Many credit the EPAct legislation for this increase in production of biodiesel and jobs for Iowa citizens.[77] Without the biodiesel tax credits allotted in EPAct, biodiesel would be much too costly to produce and sell despite the fact that it outperforms regular diesel in almost every area.[78]

However, with more than a dozen plants being in place or planned for in Iowa, many agricultural leaders are afraid that there will be an overproduction that will outpace the requests.[79] There are over 100 biodiesel plants already operating or planned for construction in 34 states, and once they are all up and running, they will be able to produce 800 million gallons of biodiesel per year.[80] This would be enough to fulfill the requirement that all diesel be mixed with 2% of biodiesel, but the problem is there is no guarantee that people will buy it, and there are concerns about obtaining enough oil and waste to make it.[81]

Despite these concerns, it seems that the U.S. is moving toward making biofuels a priority on both the federal and state level. With the increasing support of the federal government, it is likely that over time there will be more laws of this kind passed on the federal and state level. Yet, many still do not understand what exactly bioenergy is.

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72. *Id.*
73. *Massive Biodiesel Plant, supra* note 27.
74. *Id.*
75. *Id.*
76. *Id.*
77. *Id.*
78. *Id.*
79. Philip Brasher, *Biodiesel Boom Fuels Concerns*, THE DES MOINES REGISTER, Nov. 7, 2005, at A1 [hereinafter Brasher].
80. *Id.* at A4.
81. *Id.*

B. *What is Bioenergy?*

Despite the fact that it appears the U.S. is moving toward the increased development and use of bioenergy, and that bioenergy is made from many of the products that people see and use in their everyday lives, many people do not know or understand what bioenergy is. However, with more education, research, development, and implementation of use, everyone will soon learn that bioenergy might be the answer to the foreign oil dependence problem faced by the U.S. and other similarly dependent countries throughout the world.

1. *Bioenergy Summary*

Bioenergy is a very large renewable energy source and has been "[a] primary source of energy for most of human history."[82] Bioenergy is made from resources that can be regenerated, and cannot be depleted.[83] Bioenergy is viewed as a renewable resource because it utilizes resources that can be rapidly renewed, and are readily available, as opposed to fossil fuels (coal, oil, and natural gas) which take thousands of years to regenerate.[84] Some of the rapidly renewable materials that can be used to make bioenergy include organic materials, such as wood and crops (corn and soybeans), as well as many human-generated wastes, and waste from consumer, municipal, industrial, and agricultural processes such as construction and landfills.[85] All of these materials are sources of fuels that produce energy when burned.[86] There are many types of bioenergy, with one of the most important being biofuels (ethanol and biodiesel).[87]

2. *Bioenergy Further Defined*

Bioenergy is the "fourth largest energy resource after coal, oil and natural gas."[88] Nearly every part of the world has some type of resource, usually

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82. *See* Mass. Tech. Collaborative, *Bioenergy Overview*, http://www.mtpc.org/cleanenergy/biomass/overview.htm (last visited Jun. 12, 2007) [hereinafter Mass. Tech. Collaborative].

83. U.S. Dep't. of Energy, *Biomass Program: Biomass FAQs*, http://www.eere.energy.gov/biomass/biomass_basics_faqs.html (last visited Jun. 12, 2007) [hereinafter DOE, *FAQs*].

84. Mass. Tech. Collaborative, *supra* note 82.

85. *Id.*

86. *Id.*

87. *See* DOE, *FAQs*, *supra* note 83.

88. Iowa State Univ., Office of Biorenewables Programs, *Biomass*, http://www.biorenew.iastate.edu/resources/frequently-asked-questions/biomass.html (last visited Jun. 12, 2007).

called biomass, which can be used to make some type of bioenergy power because biomass is basically any type of vegetation.[89] This could include "trees, grasses, plant parts such as leaves, stems and twigs, and ocean plants."[90]

There is much energy stored in vegetation because it goes through photosynthesis.[91] In photosynthesis, the plant builds bonds between the carbon dioxide from the air and water from the ground to make carbohydrates; "the solar energy that drives photosynthesis is stored [in these] chemical bonds." [92] When the biomass is efficiently burned, the energy stored in the chemical bonds is released and oxygen in the air mixes with the carbon in the plants to make carbon dioxide and water.[93]

a. *Biomass*

Basically, biomass is "renewable biological material, primarily plant matter or products derived from plant matter."[94] Biomass can be used to produce various types of energy and to assist daily life in various ways. Heat can come from burning various types of biomass and "essentially all bioenergy fuels [made from biomass] can be used to directly produce heat."[95] Some examples of this include wood stoves in homes (which also enables cooking) and process heat/steam in industries like pulp and paper.[96] Construction and landfill waste, wood, and biofuels can be converted into electricity.[97] Transportation also benefits from biomass in the form of ethanol and biodiesel fuels.[98] The inedible fibrous, woody portions of plants, such as corn stalks, wood chips, saw dust, etc, are called "cellulosic" biomass.[99] Cellulosic biomass is a "complex carbohydrate[] that can be broken down into simple sugars convertible to ethanol."[100]

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89. *Id.*
90. *Id.*
91. *Id.*
92. *Id.*
93. EcoGeneration Solutions, LLC, *Renewable Energy Technologies*, http://www.cogeneration.net/Renewable_Energy_Technologies.htm [hereinafter EcoGeneration] (last visited Jun. 14, 2007).
94. U.S. Dep't of Energy Office of Sci., *Biofuels for Transportation*, http://genomicsgtl.energy.gov/biofuels/transportation.shtml (last visited Jun. 14, 2007) [hereinafter DOE Office of Sci.].
95. Mass. Tech. Collaborative, *supra* note 82.
96. DOE, *FAQs*, *supra* note 83.
97. Mass. Tech. Collaborative, *supra* note 82.
98. *Id.*
99. DOE Office of Sci., *supra* note 94.
100. *Id.*

Plus, many very useful chemicals can be produced from biomass and some of these are the same chemicals that are made from fossil fuels.[101]

b. *Biofuel: Defined*

Biofuel is also known as biomass fuel.[102] The term biofuel is used for liquid fuels such as ethanol and biodiesel that are made from biomass.[103] These liquid fuels are mostly used for transportation.[104]

These fuels are often labeled with numbers and letters.[105] The number following the letter in biomass gases, such as B100 or E10, represents the percentage of biodiesel or ethanol in the fuel.[106] For example, if ethanol is blended with gasoline and listed at E85, this means that 85% is ethanol and 15% is gasoline.[107] Likewise, pure biodiesel would be known as B100; yet, the most common blend of biodiesel with petrodiesel is B20, 20% biodiesel and 80% petrodiesel.[108]

i. *Ethanol*

The most commonly used biofuel is ethanol.[109] It has been around since the 1880s when Henry Ford designed a car to operate entirely on ethanol.[110] Basically, ethanol is made by fermenting plant sugars.[111] It can be made from anything containing sugar, starch or cellulose such as "corn, potatoes, wood, waste paper, wheat, brewery waste, and many other agricultural products and food wastes."[112] Although it can be made from a variety of products, over 90 percent of ethanol in the U.S. is made from corn.[113] Ethanol is made using a process similar to brewing beer where starch crops are converted into sugars, the sugars are

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101. DOE, *FAQs*, *supra* note 83.
102. *Id.*
103. *Id.*
104. *Id.*
105. *See id.*
106. DOE, *FAQs*, *supra* note 83.
107. *See id.*
108. EPA, *Clean Alternative Fuels: Biodiesel* (Mar. 2002), http://eerc.ra.utk.edu/etcfc/docs/EPAFactSheet-biodiesel.pdf [hereinafter EPA, *Biodiesel*].
109. DOE, *FAQs*, *supra* note 83.
110. EPA, *Biodiesel*, *supra* note 108.
111. *Id.*
112. BNET, http://search.bnet.com/search/waste.html (last visited Jun. 14, 2007) (referencing the EPA, *Biodiesel* article).
113. *Id.*

fermented into ethanol, and then the ethanol is distilled into its final form.[114] When it is "made from cellulosic biomass materials instead of traditional feedstocks (starch crops) [it] is called bioethanol."[115]

Due to the Clean Air Act Amendments of 1990, "[e]thanol is used to increase octane and improve the emissions quality of gasoline."[116] The use of certain ethanol-gasoline blends is approved by all automobile manufacturers that do business in the United States.[117] Fuel ethanol blends can be used in various types of vehicles and engines, and approved ethanol blends will likely be found in the owner's manual of most cars.[118]

ii. *Renewable Diesel Fuels: E-Diesel, Fisher-Tropsch Diesel, and Biodiesel Summary*

The other types of biofuels are known as renewable diesel fuels. These fuels are used in diesel engines and instead of being blended with petroleum diesel, the fuel is made from renewable resources like vegetable oils, animal fat, or other biomass like grass and trees.[119] Recently, new renewable diesels have been produced such as E-diesel and Fischer-Tropsch diesel.[120]

1. *E-Diesel & Fischer-Tropsch Fuel.* E-diesel is projected to be the next renewable diesel fuel.[121] It is made from grains like corn, and is "a blend of ethanol and diesel fuel with other chemicals to improve the performance of the blend."[122] Fischer-Tropsch diesel is currently made from coal and natural gas, but there is potential that it will be made out of organic materials, such as grass

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114. U.S. Dept. of Energy, *Biofuels for Sustainable Transportation, available at* http://www.nrel.gov/docs/fy00osti/25876.pdf.

115. Id. at 3.

116. U.S. Dept. of Energy, *Biomass Energy Data Book: Ethanol Overview,* http://cta.ornl.gov/bedb/biofuels/ethanol/Ethanol_Overview.shtml (last visited Jun. 14, 2007).

117. *Id.*

118. *Id.*

119. U.S. Dep't of Energy, *Biomass Program: ABC's of Biofuels,* http://www1.eere.energy.gov/biomass/abcs_biofuels.html (last visited Jun. 14, 2007).

120. *See* U.S. Dep't of Energy, Office of Energy Efficiency and Renewable Energy, *Biomass Program: Renewable Diesel Fuel,* http://www1.eere.energy.gov/biomass/renewable_diesel.html (last visited Jun. 14, 2007) [hereinafter *Renewable Diesel Fuel*]; *see also* Nat'l Renewable Energy Lab., *Nonpetroleum Based Fuels: Gas-to-Liquid Fuels,* http://www.nrel.gov/vehiclesandfuels/npbf/gas_liquid.html (last visited Jun. 14, 2007).

121. *See Renewable Diesel Fuel, supra* note 120 (note, however, that the Department has lessened its focus on this form of fuel).

122. U.S. Dep't of Energy, *Guide to Tribal Energy Development: Biomass Energy-Biofuels,* http://www.eere.energy.gov/tribalenergy//guide/biomass_biofuels.cfm (last visited Jun. 14, 2007).

and trees, in the future.[123] This liquid is made by converting coal and natural gas into "high-value, clean-burning fuel."[124] Despite the fact Fischer-Tropsch diesel has been around since the 1920's, it has not been very widely used.[125] Rather, the most commonly used renewable diesel is biodiesel.[126]

2. *Biodiesel.* When Rudolph Diesel invented the diesel engine in 1895, he intended for it to run on a variety of fuels, including vegetable and peanut oil.[127] Later, the diesel engine was changed to run on petrodiesel because it was less expensive.[128] However, the diesel engine is still able to run on biodiesel fuel today.[129]

Biodiesel can be made from renewable resources such as soybean oil, vegetable oil, canola oil, sunflower oil, cottonseed oil, animal fats, and recycled restaurant grease.[130] However, most of the biodiesel produced in the United States is made from soybean oil or restaurant greases.[131] These products go through a process called transesterification.[132] This process adds alcohol (usually methanol) to the organic oils, and a chemical alteration takes place to form the components of biodiesel (fatty-acid akly esters) which are long chains of carbon molecules with one alcohol molecule connected at one end.[133] These esters may be mixed with regular diesel or used as neat fuel, 100% biodiesel.[134]

As can be seen, both ethanol and biodiesel can be made from various forms of biomass, renewable resources. Unlike scarce fossil fuels, the prevalence of biomass will assist in making it easy to find the resources needed to make ethanol and biodiesel.[135] However, just as with the production and use of fossil fuels, there are many advantages and disadvantages involved with biofuels.

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123. EPA, *Clean Alternative Fuels: Fischer-Tropsch*, http://www.naftc.wvu.edu/technical/factsheets/fishfactsheetepa.pdf (last visited Jun. 14, 2007) [hereinafter EPA, *Fischer-Tropsch*].

124. *Id.*

125. *Id.*

126. *See* DOE, *FAQs*, *supra* note 83.

127. EPA, *Biodiesel*, *supra* note 108.

128. *Id.*

129. *Id.*

130. *See* EPA, *Fischer-Tropsch*, *supra* note 123; DOE, *FAQs*, *supra* note 83.

131. DOE Office of Sci., *supra* note 94.

132. DOE, *FAQs*, *supra* note 83.

133. U.S. Dep't of Energy, Alternative Fuels Data Ctr., *How is Biodiesel Made?*, http://www.eere.energy.gov/afdc/altfuel/bio_made.html (last visited Jun. 14, 2007).

134. *Renewable Diesel Fuel*, *supra* note 120.

135. DOE, *FAQs*, *supra* note 83.

C. *Advantages and Disadvantages of Bioenergy Fuels*

Although it is a great goal to achieve, helping to relieve the U.S. of its dependence on foreign oil is not the only advantage of biofuels. There are many advantages to using and developing biofuels.[136] However, with every advantage there is an equal or greater disadvantage.[137] Lawmakers and government officials will need to evaluate all the pros and cons in order to ascertain the best course for the U.S., especially any consideration involving the economy and/or the environment.

1. *Economy*

Developing, producing, and using biofuels can help regional economies and power security.[138] Bioenergy development assists in creating jobs, particularly in rural areas.[139] Currently, as many as 150,000 jobs, mostly in rural areas, are supported by activities involving bioenergy.[140] In the next 15 years, bioenergy development and use will have grown so much that approximately 260,000 to 300,000 bioenergy related jobs will be available in the U.S. and could "substantially revitalize rural economies."[141]

Not only will there be an increase in jobs, but the increased production and use of biofuels will "create [at least] an additional $91.5 billion in household income."[142] Further, a report issued by Iowa State University researchers concludes that all ethanol plants will contribute to local economies, particularly with the creation of jobs, and locally owned plants will contribute the most because the owners will spend their dividends within the community.[143]

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136. *See* Mass. Tech. Collaborative, *supra* note 82.

137. *See generally* Iowa Corn, *Ethanol Myths*, http://www.iowacorn.org/ethanol/ethanol_3b.html (last visited Jun. 16, 2007) [hereinafter Iowa Corn, *Myths*].

138. Mass. Tech. Collaborative, *supra* note 82.

139. Iowa Corn, *Facts*, *supra* note 7.

140. *Id.*

141. IEA Bioenergy, *In What Ways Can Local Communities Benefit from Bioenergy Use?*, http://www.aboutbioenergy.info/benefits_education.html (last visited Jun. 16, 2007); *see also* Iowa Corn, *Facts*, *supra* note 7.

142. Iowa Corn, *Facts*, *supra* note 7 (for example, currently, ethanol production alone has boosted farm income by $4.5 billion in the U.S., and by 2012 this number could increase to $51 billion).

143. Swenson & Eathington, *supra* note 69; Bernton, *supra* note 64.

In addition to economic gains, using biomass to produce biofuels can lead to energy security by significantly reducing the need to import oil. [144] Biomass is more evenly distributed over the earth's surface than other energy sources.[145] Thus, it provides more opportunity for energy self-sufficiency on the local and national level.[146]

However, there are other economic influences that could prevent biofuel projects from taking place. Some of these "include competition for land-use, public resistance to proposed land-use changes, and the complexity of coordinating various activities and institutions" such as farmers, utilities, transport companies, and so on.[147] Logistics of chemical composition for biofuels is also a challenge.[148]

Ethanol blended gasoline cannot be mixed with other gas in summer months and it must be transported and stored separately from other gasoline.[149] Plus, most ethanol production occurs in the Midwest; thus, it would need to be transported via railway or marine cargo, neither of which are a viable option.[150] Similarly, biodiesel will solidify in low temperatures.[151] This makes storing and transporting biodiesel in cold climates very costly.[152]

Additionally, vehicles using biofuels may receive lower gas mileage.[153] For example, a car using ethanol will have a 2% decrease in gas mileage.[154] This means a vehicle that averages 30 miles per gallon on the highway will only achieve 29.4 miles per gallon when running on ethanol.[155]

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144. *See* U.S. Dep't of Energy, Biomass Program, *National Energy Security*, http://www1.eere.energy.gov/biomass/national_energy_security.html (last visited Jun. 16, 2007).

145. DOE, *FAQs*, *supra* note 83.

146. *Id.*

147. E+Co: Energy Through Enterprise, *A Guide for Entrepreneurs on Income Generating Activities: Applications of Clean Energy Technologies for Productive Uses* 24, http://www.eandco.net/publications/03%2012%2031%20Productive%20Uses%20Manual.pdf (last visited Jun. 16, 2007) [hereinafter E+Co].

148. *Id.*

149. *EIA: ULSD, Decreased MTBE Use May Result in Volatile Markets This Year*, 10 GLOBAL REFINING & FUELS REP. 2 (Jan. 18, 2006), *available at* 2006 WLNR 1302303.

150. *See* Joseph Dipardo, *Outlook for Biomass Ethanol Production and Demand*, *available at* http://www.eia.doe.gov/oiaf/analysispaper/biomass.html (outlining transportation and distribution issues for ethanol including cost, location, distance, time for shipment, etc.) [hereinafter Dipardo].

151. Consumer Energy Council of America, *Bio-Fuel Facts*, http://www.cecarf.org/Programs/Fuels/Fuelfacts/Bio-Fuels%20Facts.html (last visited Jun. 16, 2007) [hereinafter Consumer Energy Council].

152. *Id.*

153. *See* POPULAR MECHANICS, *The Great Alt-Fuels Rally*, *available at* http://media.popularmechanics.com/documents/Fuel_of_the_Future-e852.pdf (comparing alternative fuels to the standard petroleum-based fuels commonly used today).

154. Iowa Corn, *Myths*, *supra* note 137.

155. *Id.*

With all of these economic influences in mind, however, the cost to bring biofuels to the mass market may be the biggest barrier to large-scale consumption. In the U.S., United Kingdom, and Australia, the cost to produce liquid biofuels is about three times as much as the cost of producing petroleum fuels.[156] In the U.S., B20 biodiesel is usually 30 to 40 cents more than regular diesel,[157] and Fischer-Tropsch fuels are usually around 10% more than regular diesel.[158] Conversely, ethanol is not quite as expensive. In the Midwestern region of the U.S., ethanol blends are very comparable to regular gasoline and are usually sold at the same or even lower prices.[159] Yet, in countries such as India and Brazil the cost is not as high because both use sugar to produce ethanol, as opposed to grains.[160]

For example, in Brazil, where there are high yields of sugar, facilities have been developed to efficiently produce both ethanol and electricity, and labor costs are low.[161] This results in the cost of producing ethanol from sugarcane being relatively the same as the cost of gasoline.[162] Similarly, the costs of producing biofuels is also much less in tropical and subtropical countries or developing countries.[163] This is because of lower costs of land and labor.[164] Thus, the potential for the production of sugar cane ethanol in developing countries all over the world is very promising.[165]

However, this is not the case for the U.S. The U.S. is not a subtropical or developing country, nor is the U.S. dense in sugar cane. Thus, if biofuel production and consumption is to be a success in the U.S., it will need to be based on vegetation such as corn. Yet, there are many environmental concerns that go along with using corn and other plants as biomass for biofuels.[166] These concerns will need to be weighed against the environmental and economic advantages.

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156. Rachel Gantz, *Report: Biofuels Could Displace 5% of World's Gasoline Demand*, 8 GLOBAL REF. & FUELS REPORT § 11 (May 26, 2004), *available at* 2004 WLNR 16675441 [hereinafter Gantz].

157. EPA, *Biodiesel*, *supra* note 108.

158. *Id.*

159. *Id.*

160. Gantz, *supra* note 156.

161. *Id.*

162. *Id.*

163. *Id.*

164. *Id.*

165. *Id.*

166. *See* IEA BIOENERGY, Task 31 News, http://www.ieabioenergy.com/library/148_Task31200101.pdf (last visited Jun. 16, 2007) [hereinafter IEA BIOENERGY].

2. *Environment*

Besides helping to relieve the depletion of fossil fuels, there are various environmental advantages to using biofuels. Some of these include a reduction in emissions, protection of groundwater and effects on soil and biodiversity.[167] However, with every advantage there are also equal or greater disadvantages.

Burning biofuels reduces emissions, thus, improving the air quality.[168] Unlike fossil fuels that emit greenhouse gases, such as carbon dioxide, which enhance the greenhouse effect of global warming, biomass technologies produce little to no carbon dioxide.[169] Substituting bioethanol for gasoline and biodiesel for diesel reduces carbon monoxide and sulphur oxides normally emitted from these fuels, which are generally thought to be the cause of pollution-induced public health problems in urban areas.[170] B20 is said to reduce carbon monoxide and hydrocarbon emissions by 10%, particulate emissions by 15%, sulfate emissions by 20%, and to increase nitrogen oxide emissions by 2%.[171] Similarly, B100 is said to reduce carbon monoxide emissions by 50%, particulate emissions by 70%, hydrocarbon emissions by 40%, sulfate emissions by 100%, and it increases nitrogen oxide emissions by 9%.[172] Likewise, burning ethanol reduces carbon monoxide by 40%, particulate emissions by 20%, nitrogen oxide emissions by 10%, and sulfate emissions by 80%.[173] All of these reductions in emissions play a very important role lowering the health risks associated with pollution.

However, there are harmful emissions in using ethanol and biodiesel. Use of these biofuels may raise levels of nitrogen oxides.[174] Plus, when burned, biodiesel and regular diesel release the same amount of hydrocarbon emissions.[175] Thus, not all emissions from biofuels are environmentally friendly.

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167. U.S. Dep't of Energy, Biomass Program, *Environmental Benefits*, http://www1.eere.energy.gov/biomass/environmental.html (last visited Jun. 16, 2007).

168. *See* Mass. Tech. Collaborative, *Bioenergy Benefits and Barriers*, http://www.mtpc.org/cleanenergy/biomass/benefitsbarriers.htm (last visited Jun. 16, 2007).

169. Mass. Tech. Collaborative, *Bioenergy Benefits and Barriers*, http://www.mtpc.org/cleanenergy/biomass/benefitsbarriers.htm (last visited Jun. 16, 2007); U.S. Dep't. of Energy, Biomass Program, *Biomass Today*, http://www1.eere.energy.gov/biomass/biomass_today.html (last visited Jun. 16, 2007).

170. *See* IEA, *Environment Emission Reduction*, http://www.aboutbioenergy.info/environment_emission.html (last visited Jun. 16, 2007).

171. EPA, *Biodiesel*, *supra* note 108.

172. *Id.*

173. *Id.*

174. Consumer Energy Council, *supra* note 151.

175. *Id.*

On the other hand, growing bioenergy crops helps the environment by protecting groundwater. Groundwater is protected in two ways. One way is that bioenergy crops can filter out harmful agricultural chemicals which in turn mitigates the impact of these chemicals on groundwater.[176] The other way is that biofuels are biodegradable; thus, there is less of a concern regarding spills and leaks in comparison to fossil fuels.[177] However, any gasoline mixed with ethanol or petrodiesel that is mixed with the biodiesel would still be a problem if a spill were to occur.[178]

Although bioenergy crops can protect groundwater, the removal of these crops from the soil can be harmful to the natural replenishment process of nutrients back into the soil.[179] Fertile soil needs various nutrients such as phosphorous, potassium, nitrogen, calcium, magnesium, and sulphur.[180] Normally, when a plant dies, or sheds, its nutrients are restored to the soil as the plant dissolves back into the ground.[181] However, bioenergy production that requires the removal of energy crops or residues from forests or agricultural fields can prevent the natural replenishment process from happening and eventually cause a depletion in soil fertility.[182]

Similarly, the removal of energy crops from the soil can have a negative effect on biodiversity.[183] Diversity of living organisms is important to help regulate the atmospheric gases, protect coastal zones, conserve fertile soils, and to disperse and breakdown wastes and pollutants.[184] Plus, the health of humans is also dependent on biodiversity.[185] Removing energy crops to be used for bioenergy could potentially have an adverse effect on the biodiversity of an area of the Earth by depriving that area of certain species and habitats.[186]

At the same time, while the bioenergy crops are planted, they help to prevent soil erosion.[187] Plus, bioenergy crops can often be planted in marginal or

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176. IEA BIOENERGY, Environment – Groundwater Protection, http://www.aboutbioenergy.info/environment_groundwater.html (last visited Jun. 16, 2007)

177. *Id.*; EPA, *Biodiesel*, *supra* note 108.

178. *See* EPA, *Biodiesel*, *supra* note 108.

179. IEA BIOENERGY, Environment – Soil, http://www.aboutbioenergy.info/environment_soil.html (last visited Jun. 16, 2007).

180. *Id.*

181. *Id.*

182. *Id.*

183. *Id.*

184. IEA BIOENERGY, Environment – Biodiversity, http://www.aboutbioenergy.info/environment_biodiversity.html (last visited Jun. 16, 2007).

185. *Id.*

186. *See Id.*

187. E+CO, *supra* note 147, at 24.

degraded areas in which other plants might not survive, and they increase food-crop yields while decreasing the fertilizer use needed for some species.[188]

These are just some of the advantages and disadvantages that would need to be considered in evaluating if bioenergy development and use is the best path to take. It seems that with careful planning and research, some of the disadvantages could be avoided and the overwhelming advantage of energy security and less dependence on foreign oil may outweigh the rest.

IV. THE POTENTIAL FOR GROWTH

A. *Worldwide*

A study by the International Energy Agency predicts that in the future the annual growth rates of biomass fuels "would be about 7% for Europe, 2.5% for North America and Brazil, and 2.3% for the whole world."[189] This equates to an increase of 30 billion liters of biomass fuel in 2003 to over 40 billion by 2020.[190] Due to recent legislation and initiatives promoting biofuels, this same study predicts there could be a displacement of 5% of the world's gasoline demand by 2010.[191] Plus, the implementation of these initiatives means the world biomass fuel production will likely quadruple by the year 2020, with the production of 120 billion liters of biomass-related fuel.[192]

The growth process will be gradual for some biofuels, but it will likely happen. For example, in 2004, the total amount of biofuel sales worldwide was $15.7 billion, with only $1.6 billion from biodiesel.[193] However, it is projected that by 2015, the total number of biodiesel sales could be as much as $7.1 billion.[194]

B. *United States*

In the U.S., the use of biofuels is growing. Currently, biodiesel is most frequently used by fleet operators.[195] However, the U.S. is making progress and increasing availability to a wide variety of consumers.

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188. *Id.*
189. Gantz, *supra* note 156.
190. *Id.*
191. *Id.*
192. *Id.*
193. Susan Moran, *Biodiesel Comes of Age As the Demand Rises*, N.Y. TIMES, Sept. 12, 2006, at G4 [hereinafter Moran].
194. *Id.*
195. DOE, *FAQs*, *supra* note 83.

Each year more and more retailers are supplying biodiesel and, therefore, more and more people are getting the opportunity to use it.[196] This increase in supply has, and will likely continue to bring an increase in demand and need for more biodiesel production. In fact, today there are 76 commercial biodiesel plants in operation, which is over three times more than 2004.[197] Plus, there are plans for more refineries, some of which may be capable of brewing 100 million gallons [of biodiesel] a year.[198] This is a tremendous number considering that in 2005 the total number gallons of biodiesel produced nationwide was 75 million (again three times more than in 2004).[199] It is expected that this number (75 million) will easily be doubled by the end of 2006, and possibly could get as high as 250 million gallons.[200]

Further, the U.S. Department of Energy predicts that in the next ten years biodiesel could account for at least 10% of the U.S. diesel market.[201] This would be an increase to about five billion gallons of biodiesel.[202] Plus, ethanol is projected to be about 5% of the U.S. gas consumption by the end of 2007.[203] None of these are very staggering numbers, especially considering the U.S. consumes 140 billion gallons of gasoline each year;[204] however, they do indicate that growth will likely happen, albeit slowly.

Ethanol use is also increasing. In 2003, over 2.8 billion gallons of ethanol was added to gasoline in the U.S. to help "improve vehicle performance and reduce air pollution," but only 2% of gasoline consumed in the United States was an ethanol blend.[205] Yet, in 2004, ethanol was blended into over 30% of gasoline in the U.S., and the production of ethanol from biomass reached 3.4 billion gallons, which was up 21% from 2003, and double the production number from 2000.[206] In February 2005, there were over 200 E-85 stations in 30 states in the

196. Nat'l Biodiesel Bd., *Estimated US Biodiesel Sales*, http://www.biodiesel.org/pdf_files/fuelfactsheets/Biodiesel_Sales_Graph.pdf.

197. Moran, *supra* note 193.

198. *Id.*

199. *Id.*

200. *Id.*

201. Pamela Gaynor, *Biodiesel Gaining Steam: CMU Spinoff's Technology Could Make it a Big Player in Alternative Fuel Market*, PITTSBURGH POST-GAZETTE, Aug. 16, 2005, at C1.

202. *Id.*

203. Bernton, *supra* note 64.

204. Moran, *supra* note 193.

205. U.S. Dept. of Energy, *Biomass Energy Data Book: Ethanol Overview*, http://cta.ornl.gov/bedb/biofuels/ethanol/Ethanol_Overview.shtml (last visited Jun. 16, 2007).

206. EcoGeneration, *supra* note 93.

U.S.[207] This means that ethanol was offered by retail service stations in roughly two-thirds of the country.[208]

If these numbers are any indication, the potential for growth in the use of bioenergy in the U.S. is quite large. Each year the amount of biodiesel that is being used is growing by leaps and bounds.[209] With further research and development, it is likely that some day bioenergy could be the leading source of energy in the U.S. [210]

V. CONCLUSION: WILL BIOENERGY FUEL THE FUTURE?

Becoming energy independent and reducing dependence on foreign oil has been a goal of the U.S. for quite some time. In past years, there have been plans to increase domestic oil and gas drilling, particularly in the Arctic National Wildlife Refuge.[211] Then the government tried to promote the use of cars that would run on fuel cells powered by hydrogen.[212] Neither of these plans ever received much support from Congress or the American public, and therefore, did not assist the U.S. in achieving its goal.[213] However, the potential for biofuel being the answer to the U.S. foreign oil addiction may be the most promising plan yet.

Already this plan is getting much support from Congress, as evidenced by the passing of the Energy Policy Act of 2005, and there is also talk that the upcoming 2007 Farm Bill will include alternative fuel development provisions.[214] The American public also seems to be on board. Biofuel plants are popping up all over the country, and statistics show that the use of ethanol and biodiesel use is ever increasing.[215] These statistics are undoubtedly encouraging and a great indication of the potential for future growth and success.

Similarly, the economic and environmental advantages to developing and using bioenergy fuels outweigh the disadvantages. Developing bioenergy fuels will provide jobs and jump start regional economies, while using bioenergy fuels

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207. *Id.*

208. *Id.*

209. *See id.* (stating that the production of ethanol from biomass has doubled in the last four years).

210. *See generally*, Gantz, *supra* note 156 (suggesting that recent policy initiatives aiming to promote biofuels could lead to a dramatic displacement of the world's gasoline demand).

211. John J. Fialka & Jeffrey Ball, *Bush's Latest Energy Solution Faces Hurdles*, PITTSBURGH POST-GAZETTE, Feb. 2, 2006, *available at* http://www.post-gazette.com/pg/06033/648773.stm.

212. *See id.*

213. *See id.*

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

215. *See* Dipardo, *supra* note 150.