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HOW BRAZIL ACHIEVED ENERGY INDEPENDENCE AND THE LESSONS THE UNITED STATES SHOULD LEARN FROM BRAZIL'S EXPERIENCE

I. INTRODUCTION

The 1973 oil crisis¹ forced countries around the world to examine and revise their energy policies and explore ways to reduce their dependence on oil and other foreign energy sources.² Following this crisis, the United States³ and Brazil⁴ both worked at decreasing their energy dependence on foreign oil.⁵ The divergent policy decisions of the United States and Brazil have produced vastly different results.⁶

1. In October 1973, the Organization of Arab Petroleum Exporting Countries (OAPEC) (the predecessor of today's Organization of Petroleum Exporting Countries (OPEC)) issued an oil embargo against the United States, Canada, and the Netherlands in response to the U.S. resupply of Israel with weapons during the second Arab-Israeli War. VITO A. STAGLIANO, A POLICY OF DISCONTENT: THE MAKING OF A NATIONAL ENERGY STRATEGY 23 (2001).

2. During the 1973 oil crisis, oil prices quadrupled. *Id.*; *The Price of Oil: Marching to \$100?*, CBC NEWS, Apr. 18, 2006, <http://www.cbc.ca/news/background/oil/>. In response, countries, especially the United States and those in Western Europe and industrialized Asia, took measures to "mitigate the foreign policy and economic consequences of over reliance on oil from the Persian Gulf." STAGLIANO, *supra* note 1, at xiii.

3. Americans were affected in their everyday lives by the oil crisis. Not only did the high oil prices affect American consumers at the gas pump, but they also experienced brown-outs and rapidly rising prices on other necessities. ENERGY INFO. ADMIN., DEP'T OF ENERGY, 25TH ANNIVERSARY OF THE 1973 OIL EMBARGO (1998), <http://www.eia.doe.gov/emeu/25opec/anniversary.html>.

In the first State of the Union Address following the 1973 oil crisis, President Richard Nixon focused his address on U.S. energy policy and declared, "[l]et this be our national goal: At the end of this decade, in the year 1980, the United States will not be dependent on any other country for the energy we need to provide our jobs, to heat our homes, and to keep our transportation moving." President Richard Nixon, Address on the State of the Union Delivered Before a Joint Session of the Congress (Jan. 30, 1974), *available at* <http://www.presidency.ucsb.edu/ws/index.php?pid=4327>.

4. Brazil's motivation in searching for ways to reduce its dependence on foreign oil imports stemmed from the economic recession it experienced as a result of the 1973 oil crisis. The oil crisis hit Brazil particularly hard since Brazil imported eighty percent of its fuel at the time. David Luhnnow & Geraldo Samor, *Bumper Crop: As Brazil Fills Up on Ethanol, It Weans Off Energy Imports*, WALL ST. J., Jan. 9, 2006, at A8. Since, in 1973, domestic oil production supplied only twenty percent of Brazil's petroleum needs, Brazil was "highly dependent on petroleum imports to satisfy its energy needs." JORGE CHAMI BATISTA, DEBT AND ADJUSTMENT POLICIES IN BRAZIL 73 (1992).

5. Oil is not only the largest source of energy in the United States, it is also the source that greatly affects and is most known to consumers. *Meeting Energy Demand in the 21st Century: Many Challenges and Key Questions: Hearing Before the Subcomm. on Energy and Resources of the H. Comm. on Government Reform*, 109th Cong. 8 (2005) [hereinafter *Energy Hearings*] (statement of Jim Wells, Director, Natural Resources and Environment, Government Accountability Office). High oil prices directly affect consumers because two of oil's most known uses are to provide fuel to heat

In analyzing the strategies, resources, and policy decisions of these two nations, this Note explores why, although both the United States and Brazil began in similar positions with similar goals, the two countries have achieved essentially opposite results with regard to energy independence. In doing so, this Note places particular emphasis on the transportation sector.⁷

First, this Note provides an overview of each nation's dependence upon foreign oil as it existed in 1973 and their respective energy situations today. Next, this Note discusses the policy decisions, their implementation and subsequent impact on energy independence or dependence. Ultimately, this Note finds that while Brazil's energy policy has been far more successful than that of the United States, Brazil's particular resources and type of government played a substantial role in its success, making some of the steps taken by Brazil impractical for the United States. However, this Note argues that the U.S. complacency, indecisiveness, and lack of vision in developing an alternative energy policy resulted in its current state of energy dependence, and that it is particularly in these areas that the United States should look toward Brazil's example.

homes and for vehicles. ENERGY INFO. ADMIN., DEP'T OF ENERGY, PETROLEUM PRODUCTS (2007), <http://www.eia.doe.gov/neic/infosheets/petroleumproducts.html>.

6. Brazil was set to be energy independent by the end of 2006. David J. Lynch, *Brazil Hopes to Build on Its Ethanol Success*, USA TODAY, Mar. 28, 2006, at 1B, available at http://www.usatoday.com/money/world/2006-03-28-brazil-ethanol-cover_x.htm; see also Luiz Inacio Lula da Silva, *Join Brazil in Planting Oil*, GUARDIAN UNLIMITED, Mar. 7, 2006, at 33, available at <http://www.guardian.co.uk/comment/story/0,,1725203,00.htm>. The United States, on the other hand, is far from energy independence and imported sixty-five percent of its petroleum supply in 2005. RENEWABLE FUELS ASS'N, FROM NICHE TO NATION: ETHANOL INDUSTRY OUTLOOK 2006 12 (2006), available at http://www.ethanolrfa.org/objects/pdf/outlook/outlook_2006.pdf. According to the Energy Information Administration, the United States imported sixty percent of the petroleum it consumed in 2005. ENERGY INFO. ADMIN., DEP'T OF ENERGY, WHERE DOES MY GASOLINE COME FROM? (2006), available at <http://www.eia.doe.gov/neic/brochure/gas06/gasoline06.pdf>. Future predictions of U.S. oil consumption indicate that foreign sources will continue to make up a large portion of U.S. oil consumption, and by 2025 the government expects foreign oil imports to continue to constitute sixty percent of U.S. consumption. ENERGY INFO. ADMIN., DEP'T OF ENERGY, ANNUAL ENERGY OUTLOOK 2006 8 (2006), available at [http://www.eia.doe.gov/oiaf/archive/aeo06/pdf/0383\(2006\).pdf](http://www.eia.doe.gov/oiaf/archive/aeo06/pdf/0383(2006).pdf).

7. The transportation sector accounted for sixty-seven percent of U.S. petroleum use in 2004. PETROLEUM PRODUCTS, *supra* note 5. See also *infra* note 65 and accompanying text. While electricity can be generated from coal or nuclear plants, no similar alternative source of energy exists for the transportation sector. Ariel Cohen, *Increasing the Global Transportation Fuel Supply*, EXECUTIVE MEMORANDUM (The Heritage Found., Wash., D.C.), Oct. 25, 2005, at 1, available at http://www.heritage.org/Research/EnergyandEnvironment/upload/84337_1.pdf.

II. BACKGROUND/HISTORY

Although beginning in a position economically disadvantaged as compared to the United States,⁸ Brazilian attempts to lessen its dependence on oil imports has been largely successful and has greatly outpaced that of the United States.⁹ As a result of a “three-decade long alternative energy campaign,”¹⁰ by the end of 2006, “Brazil [was expected to] achieve energy independence—a goal that the United States has been chasing without success since the energy crises of the 1970s.”¹¹

In contrast, solutions implemented by the United States to lessen its dependence on foreign oil have been limited to times of crisis, with the policy measures adopted proving largely unsuccessful.¹² Consequently, today the United States imports a much larger percentage of its petroleum supply than it did in 1973 and has made little progress in utilizing alternative, renewable fuels.¹³

While previous energy crises have usually abated in relatively short periods of time, the current state of the energy sector seems permanent,¹⁴ making Brazil's policy choices all the more enviable to the United States.

8. As a result of the oil crisis during the 1970s and the resultant strain on its foreign exchange used to pay the high oil prices, Brazil's economy slid into a deep recession. Jaclyn Fichera & Jeff Kueter, *Considering Brazil's Energy Independence*, POL'Y OUTLOOK (George C. Marshall Inst., Wash., D.C.), Sept. 2006, at 1, available at <http://www.marshall.org/pdf/materials/455.pdf>.

9. Today, Brazil is close to achieving energy independence and was expected to be energy independent by the end of 2006. Luhnnow & Samor, *supra* note 4, at A1. See also FROM NICHE TO NATION, *supra* note 6. In 2006, Brazil consumed 2.3 million barrels of oil per day. Estimates for 2007 predict that Brazil will produce 2.32 million barrels of oil per day. ENERGY INFO. ADMIN., DEP'T OF ENERGY, COUNTRY ANALYSIS BRIEFS: BRAZIL 2 (2007), <http://www.eia.doe.gov/emeu/cabs/Brazil/pdf.pdf>.

10. See Lynch, *supra* note 6. The energy campaign included a focus on ethanol and on equipping filling stations across Brazil with ethanol pumps. *Id.* at 2B. See also *infra* notes 21–25 and accompanying text.

11. *Id.*

12. ROBERT BAMBERGER, CONG. RESEARCH SERV., ENERGY POLICY: HISTORICAL OVERVIEW, CONCEPTUAL FRAMEWORK, AND CONTINUING ISSUES 3–4 (2003).

13. In 1973, the United States imported 36.1 percent of its petroleum from foreign sources. In 2005, the United States imported 65.9 percent of its petroleum from foreign sources. ENERGY INFO. ADMIN., DEP'T OF ENERGY, MONTHLY ENERGY REVIEW 17 (Dec. 2007), available at <http://www.eia.doe.gov/emeu/mer/pdf/mer.pdf>. The United States doubled the amount of petroleum it imports from 6,256 thousand barrels per day in 1973 to 13,714 thousand barrels per day in 2005. ENERGY INFO. ADMIN., DEP'T OF ENERGY, ANNUAL ENERGY REVIEW 2006 129 (2007), available at <http://www.eia.doe.gov/emeu/aer/pdf/aer.pdf>. During the same time period, renewable energy consumption only increased from 4.43 Quadrillion Btu (British thermal unit) to 6.84 Quadrillion Btu. *Id.* at 9.

14. Paul Salopek, *Oil Crisis: It's Only Just Begun*, SEATTLE TIMES, Aug. 13, 2006, at A16, available at http://seattletimes.nwsources.com/html/nationworld/2003195206_triboil13.html. Oil prices have more than tripled over the past four years from \$20 to nearly \$70 a barrel, and some analysts predict prices rising as high as \$100 a barrel. Lester R. Brown, *Starving the People to Feed the Cars*, WASH. POST, Sept. 10, 2006, at B3.

A. Brazil

Brazil's success in the utilization of alternative energy has significantly outpaced nearly all other countries, including wealthier, more developed nations. Today more than forty percent of Brazil's energy comes from renewable, alternative sources; in most richer nations, renewable energy accounts for only seven percent of the energy supply.¹⁵ In the transportation industry alone, ethanol, an alternative to gasoline that Brazil manufactures from sugarcane, accounts for twenty percent of the industry's energy supply—far greater than most other nations.¹⁶

Despite a common misperception, Brazil did not become energy independent solely due to the government mandating ethanol use, encouraging ethanol production, or building an infrastructure to support ethanol.¹⁷ Instead, following the 1973 oil crisis,¹⁸ Brazil adhered to a two-prong strategy of increasing domestic oil production through the state-owned oil company Petrobras¹⁹ and decreasing petroleum demand by developing sugarcane-based ethanol as a viable alternative.²⁰

General Ernesto Geisel, Brazil's military leader, set out to develop ethanol into a domestically-produced alternative to gasoline.²¹ Under General Geisel, Brazil focused on utilizing ethanol produced from sugarcane by offering subsidized loans to build ethanol plants, guaranteeing prices for ethanol production, funding research on ethanol-

15. Lula da Silva, *supra* note 6. In the United States, the number is even less; renewable energy accounts for seven percent of the energy supply. ENERGY INFO. ADMIN., DEP'T OF ENERGY, RENEWABLE ENERGY TRENDS IN CONSUMPTION AND ELECTRICITY 2005 (2007), available at <http://www.eia.doe.gov/cneaf/solar.renewables/page/trends/trends.pdf> [hereinafter RENEWABLE ENERGY TRENDS 2005]; *Energy Hearings*, *supra* note 5.

16. Luhnnow & Samor, *supra* note 4, at A1. Ethanol accounts for one percent of the transportation industry's fuel in the rest of the world. *Id.* Another source estimated that in 2005, Brazil's ethanol use accounted for 13.6 percent of Brazil's transportation fuel needs. Fichera & Kueter, *supra* note 8, at 3.

17. API, BRAZIL ACHIEVES ENERGY INDEPENDENCE THROUGH INCREASED DOMESTIC CRUDE OIL PRODUCTION (2006) [hereinafter API-BRAZIL REPORT], http://www.2006fuels.org/ethanol_files/Brazil-Energy-Independence.pdf.

18. In 1973, Brazil imported eighty percent of its fuel from foreign sources, and as a result the energy crisis hit Brazil particularly hard, producing an economic depression and forcing Brazil to use approximately forty percent of its foreign-exchange income to import oil. Luhnnow & Samor, *supra* note 4.

19. Fichera & Kueter, *supra* note 8, at 4. Since 1980, Brazil's domestic oil production has increased approximately nine percent per year. *Id.* By 1982, Brazil had increased investment in oil exploration and production by more than five times its 1973 level. BATISTA, *supra* note 4, at 34.

20. COUNTRY ANALYSIS BRIEFS: BRAZIL, *supra* note 9. See also Fichera & Kueter, *supra* note 8.

21. Brazil's Second National Development Plan (II NDP), as it related to energy, focused on developing a transportation infrastructure and on investing in energy to reduce oil imports. BATISTA, *supra* note 4, at 31. In 1975, Brazil named its program, which encouraged the use of ethanol, the "National Alcohol Programme." *Id.* at 89.

based automobile technology, and requiring state-owned companies to test ethanol in their fleets.²²

Ethanol was well on its way to becoming a viable alternative energy source when the 1979 oil crisis provided Brazil with an additional incentive to increase and hasten its ethanol conversion efforts.²³ General Joao Bastista Figueiredo, the new military leader, like his predecessor, focused on sugarcane-based ethanol and ordered sugar companies to increase production, required Petrobras to make ethanol available at fueling stations across the country, and provided tax breaks to companies producing ethanol-powered vehicles.²⁴ In addition, the government mandated the blending of ethanol into all gasoline.²⁵

By 1980, Brazil was close to reaching its goal of using ethanol to meet twenty percent of fuel needs.²⁶ The successful use of ethanol continued, and in the decade that followed, Brazil quadrupled its ethanol production as a result of new policies promoting sugarcane-based ethanol production and use.²⁷ By 1985, ninety percent of the new cars in Brazil ran solely on ethanol.²⁸

However, during the late 1980s and early 1990s, ethanol and Brazil's ethanol industry experienced significant setbacks.²⁹ Due in part to dramatic decreases in oil prices, the government was unable to sufficiently subsidize ethanol to make it competitive with gasoline.³⁰ Further, the government was experiencing economic and political issues³¹ that forced it to cut spending and reduce ethanol subsidies.³² Consequently, ethanol

22. Luhnnow & Samor, *supra* note 4. See also HOWARD GELLER, ENERGY REVOLUTION: POLICIES FOR A SUSTAINABLE FUTURE 117 (2003).

23. BATISTA, *supra* note 4, at 89. The 1979 oil crisis occurred as a result of the Iranian revolution. The Iranian revolution resulted in oil exports from Iran being greatly reduced, which in turn disrupted global oil supplies and dramatically increased world oil prices. STAGLIANO, *supra* note 1, at 39.

24. Luhnnow & Samor, *supra* note 4. The government also lowered the sales tax on ethanol-only vehicles and priced pure (neat) ethanol below gasoline. GELLER, *supra* note 22, at 117.

25. Trish Regan, *In Brazil, The Driving Is Sweeter*, CBS NEWS, Mar. 29, 2006, <http://www.cbsnews.com/stories/2006/03/29/eveningnews/main1454613.shtml>.

26. GELLER, *supra* note 22, at 118.

27. *Id.*

28. *Critical Issues in Brazil's Energy Sector*, BAKER INST. STUDY (The James A. Baker III Inst. for Pub. Pol'y of Rice Univ.), June 2004, at 6 [hereinafter BAKER STUDY], available at http://www.bakerinstitute.org/Pubs/study_24.pdf.

29. GELLER, *supra* note 22, at 119.

30. BAKER STUDY, *supra* note 28, at 6.

31. In 1985, the dictatorship gave way and Brazil began the transition to a democratic state. PETER KINGSTONE, THE LONG (AND UNCERTAIN) MARCH TO ENERGY PRIVATIZATION IN BRAZIL 8-10 (The James A. Baker III Inst. for Pub. Policy of Rice Univ., 2004), available at http://www.rice.edu/energy/publications/docs/BrazilEnergySector_LongUncertainMarchEnergyPrivatization.pdf.

32. GELLER, *supra* note 22, at 119.

shortages occurred, not only because ethanol producers were no longer able to profit from the manufacture of ethanol, but also because they failed to maintain an adequate supply to keep pace with an increased demand from the ethanol-only vehicles.³³ By 1995, as a result of public discontent over high ethanol prices and continuing shortages, less than five percent of the new cars in Brazil ran on ethanol.³⁴

Yet, despite the fact that the sugar and ethanol industries experienced difficult times, instead of folding, both industries chose to cut costs and improve production efficiency.³⁵ This “gamble” has seemingly paid off—oil prices have been rising since the late 1990s, particularly since September 11, 2001, and as a result, ethanol production in Brazil has surged, again enjoying a competitive advantage³⁶ over increasingly expensive gasoline.³⁷

There are several reasons why the ethanol and sugarcane industries in Brazil have survived and recently made a comeback. First, Brazil did not give up on ethanol and continuously required that all gasoline contain some percentage of ethanol.³⁸ This requirement created, at a minimum, a level of demand for ethanol that provided enough encouragement for the industries to remain alive and improve their technology and production abilities.

Second, Brazil’s ability to efficiently produce ethanol is another central reason for its success. Brazil produces sugarcane-based ethanol at about half the cost of the corn-based ethanol produced by the United States.³⁹ Third, Brazil is well positioned to produce sugarcane-based ethanol due to vast quantities of fertile land that receive ample rainfall.⁴⁰

33. *Id.*

34. BAKER STUDY, *supra* note 28, at 6. Only a decade earlier, the majority of the new cars produced ran on ethanol only. *See id.*

35. The Centro de Tecnologia Canavieira in Sao Paulo continued working to increase the efficiency of sugarcane-based ethanol. Luhnow & Samor, *supra* note 4, at A8. *See also* GELLER, *supra* note 22, at 119; *Brazil Energy Policy Review*, *infra* note 41.

36. As long as oil is over \$45 a barrel, sugarcane-based ethanol in Brazil is cheaper to produce than gasoline. Regan, *supra* note 25.

37. Brown, *supra* note 14.

38. *See* Luhnow & Samor, *supra* note 4. Brazil currently requires that all gasoline contain at least twenty-five percent of ethanol. FROM NICHE TO NATION, *supra* note 6, at 17.

39. *Brazil Boosts Ethanol Output as Prices Soar*, MSNBC.COM, Aug. 4, 2006, <http://www.msnbc.msn.com/id/14185606/print/1/displaymode/1098>. *But see* Paulo Sotero & Edward Alden, Editorial, *Building a Biofuels Alliance; How Brazil Can Be A Part of American ‘Energy Independence.’* WASH. POST, Mar. 8, 2007, at A23 (noting that sugarcane-based ethanol costs one-third less than corn-based ethanol). Not only is sugarcane-based ethanol cheaper to produce than corn-based ethanol, but it also produces as much as eight times more energy per unit of input than corn-based ethanol. James Surowiecki, *Deal Sweeteners*, THE NEW YORKER, Nov. 27, 2006, at 92.

40. Luhnow & Samor, *supra* note 4, at A1.

Fourth, and perhaps most importantly, Brazil invested in making ethanol production more efficient and has subsequently reaped the rewards of that investment.⁴¹ The efficient production of sugar-based ethanol can not occur overnight but instead results from decades of hard work and gradual improvements. "Over the past 20 years, [the government-funded ethanol research lab] has developed some 140 varieties of sugar, which has helped lower growing costs by more than one percent a year."⁴²

Finally, of particular importance is the fact that following the 1973 oil crisis, Brazil invested in an infrastructure that allows ethanol to fully compete with gasoline. Over twenty-nine thousand filling stations across the country are equipped with ethanol pumps,⁴³ which enables the market to function and allows consumers to choose equally between ethanol and gasoline.⁴⁴

Today, Brazil converts half of its sugarcane crop into ethanol⁴⁵ and expects to significantly enlarge the amount of land devoted to sugarcane in order to increase ethanol production.⁴⁶ Brazil anticipates that the increased ethanol production will further expand the nation's export of this alternative fuel.⁴⁷ The increase in exports, however, will likely occur outside the U.S. market, since the United States, in an effort to protect American farmers, imposes a fifty-four cent per gallon tax on ethanol imports.⁴⁸

A recent development in Brazil that has also greatly encouraged ethanol use is the design and implementation of flex-fuel vehicles.⁴⁹ Brazil's President touts that three-quarters of the new cars produced in

41. Ethanol production efficiency has tripled since 1975. AMERICAS SOCIETY/COUNCIL OF THE AMERICAS, BRAZIL ENERGY POLICY REVIEW: JULY 2006 (2006), available at <http://www.as-coa.org/Newsletter/July/Brazil%20Energy%20Policy-July-Final.pdf>.

42. Luhnow & Samor, *supra* note 4.

43. *Id.* at A1.

44. Since ethanol's fuel efficiency is about seventy percent of gasoline's, consumers calculate the difference in cost based on the efficiency of the two fuels. Monte Reel, *Brazil's Road to Energy Independence*, WASH. POST, Aug. 20, 2006, at A1. See also Lynch, *supra* note 6, at 2B.

45. Brown, *supra* note 14.

46. Eduardo Pereira de Carvalho, *Homework*, SAO PAULO SUGARCANE AGROINDUSTRY UNION (UNICA), Sept. 17, 2006, http://www.unica.com.br/i_pages/artigos_palavra.asp. Brazil plans to increase sugar-based ethanol production and has ample land on which to plant the sugarcane crops. Of the ninety million hectares available to plant sugarcane in the *cerrado* region, only 4.5 million hectares are currently farmed. *Id.*

47. Luhnow & Samor, *supra* note 4, at A1. Brazil expects ethanol exports to continue to rise as countries become more concerned about meeting the environmental emission requirements of the Kyoto Protocol. *Id.* Brazil further expects ethanol exports to double from \$700 million in 2005 to \$1.3 billion in 2010. *Id.*

48. *Brazil Boosts Ethanol*, *supra* note 39.

49. Fichera & Kueter, *supra* note 8, at 2-3.

Brazil are flex-fuel vehicles able to run on either ethanol or gasoline.⁵⁰ These vehicles have proven popular with consumers since their ability to run on either fuel reassures them that the situation of the late 1980s and early 1990s will not recur.⁵¹

Brazil, like most other nations, will need to constantly reexamine and adjust its energy policy.⁵² While Brazil was expected to be energy independent by the end of 2006,⁵³ energy consumption is expected to grow dramatically in the coming years.⁵⁴ The difference between Brazil and many, perhaps richer, nations, such as the United States, is that Brazil is starting at a position of energy independence—free from a need to import large quantities of petroleum.⁵⁵

B. United States

Although the United States has been aware of its energy supply problem since World War II,⁵⁶ it has failed to develop viable alternative energy sources to supplement domestic oil production and decrease reliance on foreign oil.⁵⁷ While the government has given much lip service to decreasing U.S. reliance on foreign oil and increasing domestic energy supplies,⁵⁸ there has been little success, such that renewable energy in

50. Lula da Silva, *supra* note 6. According to another source, seventy percent of Brazil's new vehicles are flex-fuel vehicles. Regan, *supra* note 25.

51. Consumers no longer worry about the future price of ethanol increasing, the availability of ethanol, or their cars becoming valueless, since their flex-fuel vehicles are able to run on either ethanol or gasoline. Regan, *supra* note 25. Reel, *supra* note 44; *see also* Lynch, *supra* note 6, at 2B.

52. Brazil was able to achieve its successes despite the fact that energy use between 1975 and 2000 increased nearly 250 percent. GELLER, *supra* note 22, at 166.

53. Luhnow & Samor, *supra* note 4, at A1.

54. BAKER STUDY, *supra* note 28, at 1. While demand is projected to increase 1.3 million bbl/d (barrels per day), domestic production is only expected to increase between 400,000 and 1.3 million bbl/d through 2015. *Id.*

55. *See* GELLER, *supra* note 22, at 169.

56. STAGLIANO, *supra* note 1, at 4.

57. The United States has been a net-importer of energy since the 1950s. NATIONAL ENERGY POLICY DEVELOPMENT GROUP, NATIONAL ENERGY POLICY 1–11 (2001), *available at* <http://www.whitehouse.gov/energy/National-Energy-Policy.pdf>. *See also infra* text accompanying note 102.

58. Nixon, *supra* note 3. Presidents following Nixon have also focused on energy policy and oil imports. For example, in a proclamation in 1980, President Jimmy Carter stated that oil “imports were entering the country in such quantities and under such circumstances as to threaten to impair the national security.” Proclamation No. 4744, 45 Fed. Reg. 22,864 (Apr. 3, 1980) (internal quotation marks omitted), *available at* <http://www.presidency.ucsb.edu/ws/index.php?pid=33217>. President Carter further stated that “[t]he high level of the Nation’s consumption of gasoline is the single most important cause of our dependence on foreign oil.” *Id.* The trend has continued to the present day as President George W. Bush has mentioned energy policy in every State of the Union Address since he was elected in 2000. *See* John Woolley & Gerhard Peters, The American Presidency Project, State of the Union Addresses of the Presidents of the United States, <http://www.presidency.ucsb.edu/sou.php>

2005 compromised only seven percent of the U.S. energy supply.⁵⁹ Of the renewable energy consumed in the United States,⁶⁰ only a small portion is used in the transportation sector.⁶¹ “Oil remains at the center of the transportation sector and at the center of our national energy policy debate.”⁶²

Due to the transportation sector's near-total reliance on petroleum, the lack of success in U.S. energy policy is felt most acutely there.⁶³ While other industries are more diversified⁶⁴ and are able to switch from one energy source to another in reaction to rising or falling prices, the transportation industry depends almost entirely on petroleum for its energy supply.⁶⁵

The U.S. approach to energy policy has been sporadic and piecemeal;⁶⁶ what has been lacking is a single coherent and consistent vision supported through times of calm and crisis.⁶⁷ While U.S. energy policy has

(last visited Nov. 9, 2007) (select desired term hyperlink for George W. Bush). *See also* BAMBERGER, *supra* note 12, at 3–4; *infra* note 66 and accompanying text.

59. RENEWABLE ENERGY TRENDS 2005, *supra* note 15, at 6; *Energy Hearings*, *supra* note 5.

60. Hydropower, which accounts for forty-five percent of renewable energy, and wood, which makes up thirty-five percent of the renewable energy used in the United States, make up the majority of U.S. renewable energy. *Energy Hearings*, *supra* note 5, at 24. If one removes hydropower from the equation, renewable energy supplies only three percent of the U.S. energy demand. MARK A. BERNSTEIN, JAY GRIFFIN & ROBERT LEMPert, IMPACTS ON U.S. ENERGY EXPENDITURES OF INCREASING RENEWABLE ENERGY USE (2006).

61. RENEWABLE ENERGY TRENDS 2005, *supra* note 15, at 13.

62. *Energy Hearings*, *supra* note 5, at 8.

63. Approximately forty percent of the energy the United States consumes is from petroleum. Petroleum has controlled approximately the same percentage of market share since 1950. CAROL GLOVER & CARL E. BEHRENS, CONG. RESEARCH SERV., ENERGY: USEFUL FACTS AND NUMBERS 16 (2004). Approximately two-thirds of the petroleum that the United States consumes is used in the transportation sector. ENERGY INFO. ADMIN., DEP'T OF ENERGY, U.S. CONSUMPTION BY SECTOR, http://eia.doe.gov/pub/oil_gas/petroleum/analysis_publications/oil_market_basics/demand_text.htm (last visited Jan. 21, 2008). It is predicted that “[i]n light of the current and expected level of imports, the United States is, and will increasingly be, subject to global market conditions, with the transportation sector especially affected.” *Energy Hearings*, *supra* note 5.

64. The residential, industrial, and commercial sectors are diversified and rely on electricity, natural gas, and coal as well as petroleum. These sectors have decreased their use of petroleum, or at least not increased their petroleum use, since 1950. Conversely, the transportation industry is not diversified and has greatly increased its petroleum dependence since 1950. ANNUAL ENERGY OUTLOOK 2006, *supra* note 63.

65. The transportation industry relies almost completely on petroleum to meet its energy demands. It has failed to diversify into other energy sources. It is thus unable to switch to another energy source when petroleum prices rise. ANNUAL ENERGY REVIEW 2006, *supra* note 13, at 42.

66. After every energy crisis, the United States temporarily focuses on energy policy and the steps needed to lessen its dependence on foreign oil. BAMBERGER, *supra* note 12, at 3–4.

67. The problem for the United States “[i]sn't so much that energy policy has failed to be responsive to crises; rather, during lengthy periods of stability and declining prices for conventional fuels, it has proven difficult to sustain certain policy courses that might help shield the nation from the occasional episodes of instability.” *Id.*

periodically received much discussion and attention,⁶⁸ the questions facing the nation have changed very little since the first energy crisis in 1973. “In 30 years, will we again come full circle and ask ourselves these same questions about our energy future?”⁶⁹

The United States, like Brazil, sought to change its energy policy following the 1973 oil crisis.⁷⁰ President Nixon instituted “Project Independence,” which predicted energy independence within a decade.⁷¹ Although Presidents Nixon and Ford attempted to push through several major energy proposals in response to the crisis, Congress was consistently reluctant to enact any sweeping changes.⁷²

During a two-year period beginning in 1975, Congress finally enacted the Energy Policy and Conservation Act (EPCA)⁷³ and Energy Conservation and Production Act (ECPA).⁷⁴ These bills focused on conservation,⁷⁵ oil price deregulation, creation of a strategic petroleum

68. The amount of government investment in alternative energy sources follows the price of oil. When oil prices increased, the government reacted and increased investment in alternative energy. However, when oil prices returned to lower levels, government investment also decreased. BERNSTEIN ET AL., *supra* note 60, at 1–2.

69. *Energy Hearings*, *supra* note 5, at 29.

70. Because President Nixon was aware of the nation’s energy problems prior to the 1973 oil crisis, he repeatedly appealed to Congress to take action in the area of energy policy. STAGLIANO, *supra* note 1, at 19–23. However, Congress refused take any action regarding energy policy prior to the 1973 oil crisis. *Id.* Some argue that the 1973 oil crisis was in the works long before 1973 in the United States due to rising consumer consumption and government price controls that kept consumer prices below real prices. Donald Losman, *Economic Security: A National Security Folly?*, POL’Y ANALYSIS (CATO Inst., Wash., D.C.), Aug. 1, 2001, at 3–4, available at <http://www.cato.org/pubs/pas/pa409.pdf>.

71. Nixon, *supra* note 3.

72. Congress, however, did provide President Nixon with emergency authority to restrict energy consumption and ration energy supplies. STAGLIANO, *supra* note 1, at 25. The only energy legislation passed and signed into law before Nixon resigned was the Federal Energy Administration Act of 1974, which established the Federal Energy Administration. *Id.* at 26. Later in 1974, Congress passed the Energy Reorganization Act, which created the Energy Resources Council and the Nuclear Regulatory Commission. *Id.* at 27.

73. The Ford Administration sought sweeping energy policy changes, such as increasing domestic oil production on federal lands and the U.S. Outer Continental Shelf, increasing tariffs on imported oil, reducing energy consumption through efficiency standards in new buildings and tax credits for homeowners, a strategic oil storage program, and aggressive research and development into new and old energy sources. STAGLIANO, *supra* note 1, at 28–30. However, Congress refused to enact most of President Ford’s proposals. *Id.* at 29–30.

74. *Id.* at 29–30.

75. The introduction of Corporate Average Fuel Economy (CAFE) standards sought to decrease the use of gasoline by increasing vehicle fuel efficiency. GELLER, *supra* note 22, at 100. The CAFE standards and a new tax on inefficient vehicles resulted in the fuel efficiency of light trucks and U.S. cars increasing approximately fifty percent between 1975 and 1985. *Id.* Congress has not increased CAFE standards since 1985, and the average fuel economy of new cars and light trucks has decreased from twenty-six miles per gallon in 1987 to twenty-four miles per gallon in 2000. *Id.*

reserve, and reorganization of federal energy resources.⁷⁶

The government instituted price controls in an effort to forcibly stabilize the oil market, but instead these price controls had extensive negative consequences. Since domestic as well as foreign oil producers were subject to the price controls, this remedy actually discouraged domestic production and encouraged the importation of crude oil because of its cheaper production costs abroad.⁷⁷ Although EPCA had provisions to deregulate oil prices, the deregulation was perceived as too gradual. In any event, the Iranian Revolution of 1979 resulted in another oil crisis.⁷⁸

Despite passage of the National Energy Act (NEA)⁷⁹ and President Carter's firm belief that the government had taken the necessary actions relating to energy policy,⁸⁰ the 1979 resulting energy crisis caught the United States off-guard once again.⁸¹

With President Reagan's election in 1980, the United States switched course in its energy strategy.⁸² Bringing to office a new theory for energy policy, Reagan advocated for and oversaw substantial deregulation of the energy sector. He believed that without government interference, the market itself would both increase domestic oil production and develop

76. STAGLIANO, *supra* note 1, at 29–30. Both the Ford and Carter Administrations believed that federal government intervention in and control over the energy market was necessary thus both sought to expand government resources dealing with energy policy. *Id.* at 28–31.

77. BAMBERGER, *supra* note 12, at 2.

78. *Id.*

79. The National Energy Act of 1978 (NEA) was a compromise with Congress in which President Carter backed away from some of his more sweeping proposals in the National Energy Plan. STAGLIANO, *supra* note 1, at 35–38. Nonetheless, the NEA was a massive undertaking and provided new conservation measures and tax incentives for homes, prohibited the use of oil in new electric generation and industrial plants, and regulated natural gas. *See id.*; MILTON COPULOS, THE HERITAGE FOUNDATION, A REVIEW OF THE CARTER ENERGY PROGRAM (1978), available at <http://www.heritage.org/Research/EnergyandEnvironment/IB27.cfm>.

80. STAGLIANO, *supra* note 1, at 37–38. The Carter Administration introduced the National Energy Plan II in 1979, which included the decontrol of oil prices, increasing the number of new oil wells, deregulation of and increased use of natural gas, increased use of coal, and tax credits and incentives for research and development into renewable energy to displace oil. *Id.* at 40–43. But, Congress again shied away from such sweeping changes. *Id.*

81. STAGLIANO, *supra* note 1, at 39. The American public again dealt with fuel shortages. Oil prices again increased dramatically, this time by eighty-two percent over the course of a few months. *Id.*

82. “The Reagan administration saw energy from an economic perspective and rejected the view that energy required special policy attention.” DON E. KASH & ROBERT W. RYCROFT, U.S. ENERGY POLICY: CRISIS AND COMPLACENCY 260 (1984). Reagan believed that oil and other energy sources should be dealt with in the same manner as other commodities. *Id.* As part of Reagan's campaign for the presidency, he pledged to get rid of the Department of Energy. Allan Pulsipher, *Watershed, Aberration, and Hallucination: The Last Twenty Years*, in THE ENERGY CRISIS 73, 73 (David Lewis Feldman ed., 1996).

alternative sources of energy.⁸³ Oil prices remained low during most of Reagan's term, and his policies seemed to achieve success in keeping prices stable and avoiding crises.⁸⁴

Reagan's market-based energy policy also proved to be resilient with subsequent administrations.⁸⁵ It was not until Iraq's invasion of Kuwait in 1990 that energy policy reemerged as a concern in the United States.⁸⁶

Despite the first Iraq War, both President George H.W. Bush and President Clinton oversaw times of relatively low oil prices and stability in the oil market.⁸⁷ Except for the period immediately following Operation Desert Storm,⁸⁸ energy policy was not a priority.⁸⁹ Indeed, after passage of the Energy Policy Act of 1992, the next major energy bill was not signed into law until 2005.

Like his predecessors, President George W. Bush sought to make his mark on energy policy and decrease U.S. dependence upon foreign oil.⁹⁰ This President's overall goal was familiar: lessening American dependence on foreign oil by increasing energy efficiency in homes and on the road, promoting alternative and renewable energy sources, and

83. KASH & RYCROFT, *supra* note 82, at 260; BAMBERGER, *supra* note 12, at 2.

84. Despite the benefits of low oil prices, Reagan's policies also served to "discourage energy efficiency and the use of alternative fuels." *Energy Hearings*, *supra* note 5, at 11. While energy efficiency increased between 1973 and 1986, the low oil prices between 1986 and 1996 produced less incentive to increase energy efficiency and energy use rose twenty-two percent. GELLER, *supra* note 22, at 134.

85. BAMBERGER, *supra* note 12, at 6.

86. Instead, the focus was on oil companies and making sure they survived the low oil prices and continued to produce and explore for new oil. Between 1968 and 2000, the U.S. government provided \$140 billion dollars in tax incentives to oil companies. GELLER, *supra* note 22, at 38.

87. Ben Lieberman, *Correcting Mistakes of the 1990s Should Top the Energy Agenda for 2006*, BACKGROUND (The Heritage Found., Wash., D.C.), Mar. 20, 2006, at 1.

88. Although President Clinton recognized the danger of increasing imports of oil from foreign sources, his administration did not address the problem and instead oversaw an increase in reliance on foreign imports, which rose from fifty-one percent in 1994 to fifty-six percent in 2000. J.C. WATTS, JR., *OVER A BARREL: THE CLINTON ADMINISTRATION'S FAILED ENERGY POLICY* (The Heritage Found., WASH., D.C. 2000), <http://www.heritage.org/Research/EnergyandEnvironment/hl661.cfm>.

89. U.S. oil consumption continued to rise throughout the 1990s. Energy Information Administration, International Petroleum (Oil) Consumption, <http://www.eia.doe.gov/emeu/international/oilconsumption.html> (last visited Dec. 24, 2007) (select appropriate format for "All Countries, Years 1980-2005 for the *International Energy Annual 2005*"). During the same time period, U.S. oil production steadily decreased. Energy Information Administration, International Petroleum Monthly (IPM), <http://www.eia.doe.gov/emeu/ipmr/supply.htm> (last visited Dec. 24, 2007) (follow "4.1c" hyperlink).

90. Woolley & Peters, *supra* note 58 and accompanying text. Early in his administration, President Bush announced his energy policy, which included the goals of fuel conservation, lessening regulation, opening the Arctic National Wildlife Refuge for exploration, and providing tax incentives for efficient vehicles and home conservation measures. John King, *Bush Energy Plan Looks to Future*, CNN.COM, May 17, 2001, <http://archives.cnn.com/2001/ALLPOLITICS/05/17/bush.energy.plan>.

increasing domestic energy sources.⁹¹ Congress and the President debated the energy bill for approximately four years, finally agreeing on EPAct 2005.

EPAct 2005 addressed many energy policy issues and provided a substantial increase in funding and incentive programs for alternative fuels.⁹² By granting tax credits to small producers of ethanol and biodiesel and to fueling stations for installation of equipment to accommodate these alternative fuels, the Act provided an additional incentive for the market to develop and produce ethanol and biodiesel.⁹³ EPAct 2005 also provided incentives to consumers for the purchase of hybrid vehicles in an effort to decrease oil consumption in the transportation sector.⁹⁴

While government investment in alternative fuels and energy efficiency has increased since 1973, the relatively low cost of fossil fuels prior to 2001 has made alternative fuels economically unappealing.⁹⁵ In 2006, ethanol made up approximately one percent of the total fuel consumed in the U.S. transportation sector and even then only as a gasoline additive.⁹⁶ Nonetheless, ethanol production has increased 126 percent since 2001, due to both the anticipation of new government subsidies and increased oil prices.⁹⁷ Moreover, ethanol production is expected to total more than eight million gallons by the end of 2007.⁹⁸

91. Press Release, The White House, Fact Sheet: President Bush Signs into Law a National Energy Plan (Aug. 8, 2005), available at <http://www.whitehouse.gov/news/releases/2005/08/20050808-4.html>.

92. EPAct 2005 introduced the Renewable Fuels Standard (RFS), which required that 7.5 billion gallons of renewable fuel be blended into the nation's fuel by 2012 and provided tax credits for motorists purchasing energy-efficient vehicles. SAMUEL W. BODMAN, DEP'T OF ENERGY, ON THE ROAD TO ENERGY SECURITY: IMPLEMENTING A COMPREHENSIVE ENERGY STRATEGY: A STATUS REPORT 11 (2006), available at http://www.doe.gov/media/FINAL_8-14_DOE_booklet_copy_sep.pdf.

93. 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 Nov. 21, 2006).

94. *Id.* EPAct 2005 switches the tax benefit for buying a hybrid vehicle from a deduction (under the 1992 Energy Act) to a credit, which should result in greater savings for consumers. However, the credit is complicated in that the amount of credit consumers may receive decreases after a certain number (60,000) of vehicles are sold by the manufacturer. Tim Gray, *You'll Need a Scorecard for Energy Tax Breaks*, N.Y. TIMES, Feb. 12, 2006, at 26.

95. BAMBERGER, *supra* note 12, at 3.

96. Thirty percent of fuel sold in the United States has some amount of ethanol blended into it. FROM NICHE TO NATION, *supra* note 6, at 2.

97. The rise was even more significant between 1980 and 2005, when ethanol production increased from 175 million gallons to 4,000 million gallons. *Id.* at 3. In comparison, Brazil produced 4,200 millions of gallons of ethanol in 2005. DEP'T OF AGRIC., THE ECONOMIC FEASIBILITY OF ETHANOL PRODUCTION FROM SUGAR IN THE UNITED STATES iii (2006) [hereinafter SUGAR FEASIBILITY REPORT], available at <http://www.usda.gov/oce/EthanolSugarFeasibilityReport3.pdf>.

98. BODMAN, *supra* note 92, at 4.

Prior to the passage of EPAct 2005, the United States' primary focus was on identifying ways to increase domestic oil supplies and, at the same time, controlling and securing foreign oil sources.⁹⁹ Although similarly focused, prior U.S. efforts to increase domestic oil supplies failed, such that domestic oil production is significantly lower today than in 1973.¹⁰⁰ As domestic production fell,¹⁰¹ imports doubled.¹⁰² The outlook to lessen U.S. energy dependence is not positive. Domestic production of oil is expected neither to increase nor to meet future petroleum needs.¹⁰³ In fact, the amount of petroleum that the United States imports is expected to increase, reaching sixty percent of demand by 2025.¹⁰⁴

No one would deny that the United States has a long way to go and that the changes made recently are but a few of those needed. Despite much talk of decreasing dependence upon foreign oil, the United States is even more dependent upon foreign sources of oil today (especially member nations of the Organization of Petroleum Exporting Countries (OPEC)) than it was in 1973.¹⁰⁵ The question is whether the United States can reverse these trends and work toward energy independence or if it will continue in this self-destructive behavior and remain dependent upon imported oil.

99. See GELLER, *supra* note 22, at 135–36; see *supra* text accompanying note 85. The focus of Presidents since Nixon has been on oil production and finding ways in which to increase production. M.A. Adelman, *The Real Oil Problem*, REGULATION, Spring 2004, at 16, 17, available at <http://www.cato.org/pubs/regulation/regv27n1/v27n1-1.pdf>.

100. In 1973, U.S. domestic oil production was 9,208 barrels per day. In 2005, U.S. domestic oil production reached only 5,178 barrels per day. ANNUAL ENERGY REVIEW 2006, *supra* note 13, at 125.

101. Beginning in the 1970s, demand greatly outpaced domestic supply. Further, domestic oil production has fallen by approximately forty percent since 1970. *Energy Hearings*, *supra* note 5, at 9.

102. ANNUAL ENERGY REVIEW 2006, *supra* note 13, at 129 and accompanying text; see *infra* text accompanying note 103.

103. "U.S. oil production began to decline in 1970 and has dropped by about 40 percent since then. Since 1970, imports of crude oil and other products have increased 255 percent, and imports now comprise nearly 56 percent of the U.S. oil supply." *Energy Hearings*, *supra* note 5, at 9. The future outlook is even more grim: "Total domestic petroleum supply . . . increasing from 8.6 million barrels per day in 2004 to a peak of 10.5 million barrels per day in 2021, then declining to 10.4 million barrels per day in 2025 and remaining at about that level through 2030." *EIA Releases 2006 Outlook; Implications for the Natural Gas Industry*, CANADIAN NAT. GAS MKT. REP., Feb. 17, 2006, at 11, available at <http://www.enerdata.com/ngmrsamp2.pdf>. Likewise, "[i]n 2025, net petroleum imports, including both crude oil and refined products, are expected to account for 60 percent of demand." ANNUAL ENERGY OUTLOOK 2006, *supra* note 6, at 8.

104. ANNUAL ENERGY OUTLOOK 2006, *supra* note 6, at 8.

105. See *supra* notes 101–03 and accompanying text. Oil imports from OPEC countries have reached forty-two percent of the U.S. total oil imports, making the United States increasingly subject to the political instability of the Middle East. *Energy Hearings*, *supra* note 5, at 9.

III. ANALYSIS

Although Brazil and the United States started in much the same position, that is, both were dependent on foreign oil and both desired energy independence, only Brazil achieved that goal in the intervening thirty years. The United States, on the other hand, has significantly regressed from its initial position and is even more dependant on foreign oil today. What lessons should the United States learn from Brazil's experience, and what steps should the United States take to lessen its dependence upon foreign oil?

While the United States had the same goal of energy independence as Brazil following the 1973 oil crisis,¹⁰⁶ the United States has been unsuccessful in its efforts and thus remains largely dependant upon foreign oil.¹⁰⁷ Likewise, the United States has made little progress in domestic oil production or in the development of alternative, renewable energy sources.¹⁰⁸

Brazil, on the other hand, has made large strides in its journey to decrease reliance on oil imports (especially in the transportation sector) through increases in the alternative energy source of sugarcane-based ethanol and domestic oil supply.¹⁰⁹

By comparing the characteristics and decisions of both countries, this Note argues that while the United States could have taken additional and alternative steps in its energy policy, it could not have duplicated Brazil in actually achieving energy independence. Nevertheless, the United States can still learn from Brazil's experience and develop a long-term plan to solve its energy dependence problem.

A. *The Benefits of a Dictatorship*

Simply put, in a dictatorship the dictator makes decisions and those decisions are then implemented. In a constitutional republic, the decision-making process, by design, is slow and cumbersome. In the United States, the President, agencies, and Congress all debated about the changes needed and the proper direction for energy policy following the 1973 oil crises.¹¹⁰ By contrast, Brazil was already implementing its vision.

106. Nixon, *supra* note 3.

107. See MONTHLY ENERGY REVIEW, *supra* note 13, at 15; see also ANNUAL ENERGY OUTLOOK 2006, *supra* note 6.

108. See *supra* notes 58–59 and accompanying text.

109. Fichera & Kueter, *supra* note 8, at 1.

110. See STAGLIANO, *supra* note 1, at 23–60.

Brazil's dictatorship of the 1970s allowed it to pursue a clear vision and goal with respect to its energy policy.¹¹¹ Instead of similarly adhering to a single policy, the United States changed its focus with nearly every change in the Executive or Congress.¹¹² Periods of crisis produced reactions from politicians due to outcries from the public. Periods of calm saw the focus shift to other issues while energy policy became secondary.¹¹³

As a dictatorship, Brazil was able to build an infrastructure to make ethanol available as an alternative energy source, require fuel pumps at filling stations to accommodate alternative fuels, and mandate that ethanol be mixed with gasoline, all within a short period of time and without alternative, dissenting voices slowing down the process.¹¹⁴ The United States, on the other hand, has been unable to institute a coherent plan,¹¹⁵ has not yet built a comparable infrastructure,¹¹⁶ and has only recently required that ethanol be mixed into gasoline.¹¹⁷

Although EPAAct2005 remains a positive step and provides some incentive to increase the amount of alternative energies produced and consumed,¹¹⁸ the United States has failed to provide for any direct investment in an infrastructure for the disbursement of alternative energies. Perhaps the easiest and most practical solution would be to grant incentives to already established fueling stations for the construction of E85 pumps. While it is unlikely that the government would mandate that all fueling stations have alternative energy pumps as Brazil did, it is possible for the United States to provide incentives to build such pumps. Doing so would not only make E85 available on a larger scale, but it

111. See Luhnow & Samor, *supra* note 4; GELLER, *supra* note 22, at 117–22.

112. BAMBERGER, *supra* note 12, at 4.

113. *Id.* at 3–4.

114. See GELLER, *supra* note 22, at 117–18.

115. Although the Nixon, Ford, and Carter administrations submitted comprehensive plans to address the energy crises, Congress refused to enact such plans in whole and instead enacted piecemeal legislative solutions. See *supra* notes 70–85 and accompanying text.

116. At the end of 2004, there were only 205 E85 (an alcohol fuel mixture made up of 85% ethanol fuel) fueling stations in the United States, most of them concentrated in the Midwest. BRENT D. YACOBUCCI, CONG. RESEARCH SERV., ALTERNATIVE TRANSPORTATION FUELS AND VEHICLES: ENERGY, ENVIRONMENT, AND DEVELOPMENT ISSUES 15 (2005). Although the number of stations has dramatically improved and as of mid-2006, there were 600 fuel stations equipped to sell E85, the number pales in contrast to the over 29,000 ethanol pumps spread throughout Brazil. Lynch, *supra* note 6, at 2B. Another infrastructure hurdle in the United States is the fact that ethanol cannot be mixed with gasoline in the pipelines, so it must be shipped, usually via train, from the Midwest. BERNSTEIN ET AL., *supra* note 60, at 10.

117. With the passage of EPAAct 2005, the United States finally set alternative fuel standards and required that ethanol be mixed into gasoline. BODMAN, *supra* note 92, at 10.

118. *Id.* at 10–11.

would also provide an additional incentive to alternative energy producers, since they would be guaranteed a place to sell their fuel. Further, car manufacturers would be more likely to produce vehicles capable of running on alternative energy and consumers would be more likely to purchase such vehicles.

B. Natural Resources and Advantages

When Brazil decided to support and develop sugarcane-based ethanol as an alternative to oil, it had the natural resources to make that happen. Brazil is blessed with ample rainfall, large quantities of unused fertile land, and cheap labor,¹¹⁹ which makes it an ideal location to produce large amounts of sugarcane.¹²⁰

The United States, on the other hand, is unable to produce large amounts of sugarcane, due largely to differences in climate, limited amounts of available farm land, and comparatively high labor costs.¹²¹ Instead, the United States has focused on the more expensive corn-based ethanol.¹²² In 2006, twenty percent of the nation's corn harvest was utilized in ethanol production,¹²³ which supplied a mere two to three percent of the nation's non-diesel automotive fuel.¹²⁴ Even if the entire U.S. grain harvest was converted into ethanol, it would only satisfy sixteen percent of U.S. transportation fuel needs.¹²⁵

Simply put, the differing natural resources in the United States and Brazil make it impossible for the United States to use either sugar or corn-based ethanol as a means of becoming fully independent given current technologies. However, in 1973 Brazil did not possess the technology to produce ethanol as efficiently as it does today.¹²⁶ Instead, over the past

119. Luhnnow & Samor, *supra* note 4, at A1.

120. Even today, Brazil has not reached its capacity to produce sugarcane. Only 4.5 million hectares of the 90 million hectares available in the *cerrado* region are used for growing sugarcane. Carvalho, *supra* note 46. Sugarcane production can and is expected to expand greatly to meet ethanol demands. *Id.*

121. See generally SUGAR FEASIBILITY REPORT, *supra* note 97.

122. Luhnnow & Samor, *supra* note 4, at A1.

123. *Agriculture and Rural America's Role in Enhancing National Energy Security: Hearing Before the S. Comm. on Agriculture, Nutrition and Forestry*, 110th Cong. 2 (2007) (statement of Keith Collins, Chief Economist, Dep't of Agric.), available at http://www.usda.gov/oce/newsroom/congressional_testimony/Collins_011007.pdf.

124. Worldwatch Institute, Biofuels for Transportation: Selected Trends and Facts, <http://www.worldwatch.org/node/4081> (last visited Dec. 24, 2007).

125. Brown, *supra* note 14.

126. See Luhnnow & Samor, *supra* notes 4, 42 and accompanying text.

three decades Brazil invested in and researched the production of sugar-based ethanol so that today it is capable of efficiently producing ethanol.¹²⁷

While more investment in corn-based ethanol will likely yield increased efficiency in the production of corn and ethanol, it is unlikely that corn alone will solve the U.S. energy dependence problem.¹²⁸ Instead, the United States needs to focus on both corn-based ethanol *and* other abundant natural resources.¹²⁹

C. Sugarcane versus Corn-Based Ethanol

It is largely accepted that cost has been the main barrier to the development of renewable energy in the United States.¹³⁰ This cost barrier is particularly apparent in U.S. ethanol production. Corn-based ethanol in the United States is significantly more expensive to produce than both gasoline¹³¹ and Brazilian sugarcane-based ethanol.¹³² The low cost of sugarcane-based ethanol allows Brazil to produce and market ethanol in competition with gasoline without the large subsidies required to make corn-based ethanol competitive in the United States.¹³³

Further, corn-based ethanol is not the end-all solution that will transform the United States into an energy independent nation. The use of traditional food sources for the production of fuel poses serious consequences to the world's poor.¹³⁴ In addition, as noted above, there are

127. See *supra* notes 41, 42 and accompanying text. As long as the price of oil is more than \$45 a barrel, sugarcane-based ethanol in Brazil is cheaper to produce than gasoline. Regan, *supra* notes 25, 36 and accompanying text.

128. See *supra* notes 121–25 and accompanying text.

129. One of the more promising alternative fuels is biodiesel, which can be made from either vegetable oils or animal fats. Not only is biodiesel made from an abundant natural resource, but it is also the only alternative fuel to meet the Clean Air Act standards because of very low emission levels. See generally National Biodiesel Board, Biodiesel: Commonly Asked Questions, http://www.biodiesel.org/pdf_files/fuelfactsheets/CommonlyAsked.pdf (last visited Nov. 10, 2007).

130. BERNSTEIN ET AL., *supra* note 60, at 1.

131. Some argue that ethanol is not only more expensive to produce than gasoline, but that it is also more harmful to the environment. Jerry Taylor & Peter Van Doren, Editorial, *Expensive, Wasteful Ethanol Can't Solve Our Problems*, CHI. SUN-TIMES, Jan. 27, 2007, at 15, available at http://www.cato.org/pub_display.php?pub_id=7308.

132. Corn-based ethanol is about one-third more expensive to produce than sugarcane-based ethanol. Regan, *supra* note 25.

133. Ethanol producers receive a wide range of government subsidies ranging from a fifty-one cent rebate on the federal fuel tax (or a fifty-four cent credit on their federal income tax), ten cent credit for small producers, and various state subsidies. Steven Pearlstein, *Going Crazy for Ethanol*, WASH. POST, May 24, 2006, at D1, D3.

134. Brown, *supra* note 14.

limits on how much ethanol could be produced even if an entire corn harvest was used to produce ethanol.¹³⁵

Brazil, however, has enough resources to greatly increase sugarcane production for use as ethanol.¹³⁶ Brazil is therefore able to cheaply produce ethanol¹³⁷ without having to devote an entire crop of sugar to ethanol production or risk potential disruption of the food supply.¹³⁸

D. Dual Strategy

It is important to remember that Brazil did not become energy independent solely through ethanol.¹³⁹ Rather, ethanol accounts for only twenty percent of Brazil's transportation fuel supply.¹⁴⁰ The remainder of Brazil's transportation needs were provided through a large increase in domestic oil production.¹⁴¹

The U.S. focus since 1973 has been on oil. Specifically, that focus has been on increasing domestic oil production, securing foreign oil sources, and keeping oil prices low.¹⁴² Any U.S. focus on alternative energy was minimal, except during sporadic periods of high oil prices.¹⁴³ Despite this focus on oil, U.S. domestic oil production has fallen over the past thirty years.¹⁴⁴ The United States is simply not blessed with large domestic oil reserves.¹⁴⁵

On the other hand, Brazil has focused on two avenues since 1973. It focused on both increasing the domestic oil supply and decreasing the amount of oil demanded by supplementing oil with ethanol for use in the transportation sector.¹⁴⁶ Again, due to the natural resources at its disposal,

135. See Luhnnow & Samor, *supra* note 4; Brown, *supra* note 14.

136. Carvalho, *supra* note 46 and accompanying text.

137. Regan, *supra* note 25.

138. Due to the vast amount of land resources available for production of sugarcane, Brazil is able to expand production to meet an increased demand for ethanol, rather than being forced to use the supply already being produced. Carvalho, *supra* note 46 and accompanying text.

139. See API-BRAZIL REPORT, *supra* note 17. See also Fichera & Kueter, *supra* note 8; BATISTA, *supra* note 4, at 34; *supra* note 19 and accompanying text.

140. Luhnnow & Samor, *supra* note 4, at A1.

141. *Supra* note 19 and accompanying text.

142. See GELLER, *supra* note 22, at 135-39.

143. BERNSTEIN ET AL., *supra* note 60, at 1-2.

144. See *supra* text accompanying note 13.

145. *Energy Hearings*, *supra* note 5, at 9. Of the known 1,317.447 billion barrels of world oil reserves, the United States has only 21.757 billion barrels of domestic oil reserves. Energy Information Administration, World Proved Reserves of Oil and Natural Gas, Most Recent Estimates (2007), <http://www.eia.doe.gov/emeu/international/reserves.html>.

146. See FROM NICHE TO NATION, *supra* note 6. See also GELLER, *supra* note 22, at 121.

Brazil was able to succeed in greatly increasing domestic oil production and increasing the use of alternative energy through ethanol production.

The United States can and should learn from Brazil's strategy of focusing on multiple avenues to decrease dependence upon foreign oil sources. Domestic oil production has not and will not solve the U.S. energy supply problem, but neither will ethanol alone. Instead, the United States should focus on several potential avenues in addition to alternative energies, including but not limited to ethanol.

An important part of the U.S. strategy, in addition to finding alternative energy sources, should be to follow Brazil's emphasis on automobiles and their fuel use.¹⁴⁷ As the United States learned from its first experience mandating CAFE (Corporate Average Fuel Economy) standards, automobile manufacturers can increase the efficiency of vehicles when required to do so.¹⁴⁸ Although EPAct 2005 started down the right path by providing incentives to businesses and consumers to purchase fuel-efficient vehicles,¹⁴⁹ the United States should further increase CAFE standards and require automobile manufacturers to produce more fuel-efficient vehicles.

IV. CONCLUSION

Brazil succeeded in becoming energy independent because it focused on becoming so, and because its natural resources and political situation enabled it to expand domestic oil production and supplement oil use in the transportation industry with ethanol. The fact that Brazil was ruled by a military dictatorship during the 1973 and 1979 oil crises enabled it to quickly and aggressively invest in domestic oil production through Petrobras and likewise invest in, mandate the use of, and build a distribution infrastructure for sugarcane-based ethanol. Brazil's natural resources and cheap labor were ideal for the production of sugarcane-based ethanol, and its continued support of and investment in ethanol greatly increased efficiency, thus making ethanol more competitive with gasoline without the need for large government subsidies.

The United States' main focus in its energy policy was on controlling the price and supply of oil. Although the government provided some support for and investment in alternative energies, these efforts were limited and without great impact. The political indecisiveness and low cost

147. See Luhnow & Samor, *supra* note 4; GELLER, *supra* note 22, at 117.

148. See GELLER, *supra* note 22, at 100–01, 139–40; *supra* note 75 and accompanying text.

149. BODMAN, *supra* note 92, at 11.

of oil during much of the last thirty years resulted in a piecemeal policy lacking a consistent vision to decrease dependence upon oil.

Although the United States cannot use Brazil as a model upon which to base its energy policy, there are lessons to be learned from Brazil's experience and from the United States' past mistakes. First, and most importantly, the United States needs to focus on one consistent plan to reduce its dependence upon foreign oil. Second, the United States should not focus on oil, but should instead focus on alternatives to oil. Third, just as ethanol did not alone make Brazil energy independent, ethanol is not the entire solution for the problematic U.S. dependence on foreign sources of oil. Finally, the United States must reduce oil consumption, especially in the transportation sector.

The United States is not without hope, but neither is it in an enviable position. It is necessary that the administration and Congress implement a clear vision and plan to decrease U.S. reliance upon foreign oil, and in doing so the United States should examine Brazil's success and take from Brazil the applicable lessons.

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