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Electric Vehicles: A Breath of Fresh Air for the Next Millennium

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Electric Vehicles: A Breath of Fresh Air for the Next Millennium

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[O]ur government needs to focus on those actions that will make a difference in our ongoing efforts to achieve acceptable air quality and pause to consider the use of strategies of which the benefits are less clear and the potential costs are high.[1]

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* B.A., 1995, Hamilton College; J.D. and Certificate in Environmental Law, expected May 1998, Pace University School of Law. The author dedicates this publication to her family and close friends who have provided her with unconditional love and support in all aspects of her life. In particular, to her brother, Robert James, whose talents and personality can never be matched; her sister, Deborah, whose creativity and skills are second to none; to her mother, Angela, who is as close to perfect as anyone could be; and to her father, Robert John, whose knowledge and success have and always will serve as the model upon which the author molds her being.

1. J.G. Calvert et al., *Achieving Acceptable Air Quality: Some Reflections on Controlling Vehicle Emission*, 261.5117 ENVTL. SCI. & TECH. 37, 38 (July 2, 1993), *available in* 1996 WL 12231135 [hereinafter Calvert].

I. Introduction

Imagine driving to work with the car windows down and the sunroof open. There is no exhaust being exuded by passing automobiles on the road. Missing are the heavy, obnoxious odors of benzene, diesel, grease and oil—the signature aromas of fossil fuel combustion. The sun is brilliantly shining because there is no smog blanketing the blue morning sky. Absent are the loud, droning noises that accompany internal combustion engine vehicles. All that echoes in your ears is the quiet and soothing hum of electric vehicles as they transport commuters to work. This Comment advocates an effective way to implement existing zero emission vehicle technology thereby allowing this image to become a reality.

Zero emission vehicles (ZEVs) do not produce any pollution while in operation.[2] The only ZEVs presently available for marketing are electric vehicles (EVs), which are powered

2. *See* Natural Resources Defense Council, *Zero Emission Vehicles* (last modified Oct. 22, 1996) <http://www.nrdc.org/nrdc/bkgrd/trev.html> [hereinafter NRDC].

by battery as opposed to fuel.[3] These batteries are rechargeable and recyclable, thereby further reducing any negative environmental impacts of EVs as well as the demand on the world's diminishing oil supply. A few years ago, when EVs began to reappear,[4] critics argued that the lead emissions produced by electrical power plants that charge EVs, in addition to battery production, use and disposal would simply displace the tailpipe emission of Internal Combustion Vehicles (ICVs)[5] instead of actively improving air quality.[6] This argument was proven to be without merit by a number of credible scientific and technological studies.[7] Presently, the greatest opposition to EVs focuses not on *if* they should be implemented, but *when* and *how* to successfully integrate this new and environmentally beneficial transportation technology.

This Comment asserts that Memoranda of Agreement (MOA), executed contracts between automobile manufacturers and governmental agencies, are the most effective means to successfully integrate EVs into society in order to clean the air and reduce human reliance on oil and natural gas. MOAs require automobile manufacturers to produce and sell EVs based on local market forces. Other governmental methods,

3. *See id.*

4. EVs actually made their original debut over a century ago in 1896. *See Technology Problems Helped Cause Demise of First Generation of EVs*, 33.44 AIR/WATER POLLUTION REP.'S ENV'T WK., Nov. 3, 1995, *available in* 1996 LEXIS 1082-8575. Like today's EVs, their predecessors were powered by lead-acid batteries very similar to the type presently used by most manufacturers. *See id.* The early EVs gave their gas-powered counterparts competition, but their manufacture eventually ceased and EVs disappeared due to technical, social and cultural factors. *See id.*

5. Gasoline-fueled automobiles are ICVs. *See Life Cycle Analysis: Getting the Total Picture on Vehicle Engineering Alternatives*, AUTOMOTIVE ENGINEERING 11 (Mar. 1, 1996).

6. *See id.*

7. *See CTA Findings Reveal Carnegie-Mellon Study Misrepresents Environmental Impacts of Electric Vehicles*, 1.1 CTA TRANSP. TECH. REV. (Dec. 1995). *See also Lead Batteries More Polluting, Researchers Say*, L.A. TIMES, May 10, 1995, at D2.

namely mandates and the *laissez faire*[8] approach, do not allow for effective EV integration.

This Comment analyzes why EV use is imperative at this time in order to help purify the air as well as lessen human reliance on finite oil and natural gas energy resources. This Comment also explains why MOAs are the most effective instruments for EV integration. Part II of this Comment explains the environmental concerns, as well as laws and regulations that have led to the emergence of EVs as a viable, although only partial, solution to poor air quality. Part II also outlines the environmental pros and cons of EVs, and what is and can be done by legislatures to encourage EV sales and use. Moreover, Part II of this Comment explains why it is necessary for the United States to cease its reliance on foreign oil and natural gas resources and how EVs can help to achieve this goal. Part III analyzes the advantages of EVs over ICVs, and explains why MOAs are more practical for EV integration than mandates or no governmental input at all. Part III describes programs that states can employ as incentives for EV marketing and sales. Additionally, Part III provides guidelines that state and federal governments can follow to promote the sales of currently existing EVs and to further research and development of these vehicles in the future. Part IV concludes that the environmental, economic and political benefits of EVs make them superior to present ICVs and that MOAs are the most economic and environmentally beneficial way to integrate EVs into society.

II. Background

A. Motor Vehicle Emission

In the United States, the most important urban air pollution problem today is photochemical smog.[9] ICVs are the

8. *Laissez faire* literally means "let (people) do, or make (what they choose); hence, non-interference." WEBSTER'S NEW INT'L DICTIONARY OF THE ENGLISH LANGUAGE 1384 (2d ed. 1958). *See also infra* Part III.B

9. *See* Calvert, *supra* note 1. The term "photochemical smog" is defined as:

> [M]urky, heavily polluted air, especially laden with sulfur dioxide, nitrogen dioxide, and other pollutants commonly produced by automobiles and industrial manufacturers. Sunlight exacerbates

largest source of air pollution,[10] responsible for more than one-half of the smog-forming emission in urban areas.[11] ICVs are responsible for 75% of the hydrocarbon (HC) emission, 45% of the nitrogen oxide (NO_x) emission, 34% of the volatile organic compound (VOCs) emission,[12] almost all of the carbon monoxide (CO) emission, and one-half of the ozone[13] pollution in cities.[14]

The effects of automobile pollutants are far-reaching and grave. When oxidants[15] such as ozone reach sufficiently high concentrations in the air, "they impair breathing capacity, cause eye irritation, and damage materials, vegetation, and crops."[16] Symptoms of ozone health effects include chest

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> the situation, triggering a photochemical reaction, in which nitric oxide produced by automobile exhaust is transformed into the toxic . . . nitrogen dioxide. Smog irritates and damages the eyes, throat, and respiratory system, but in extreme cases – especially when people already have cardiorespiratory problems – it can trigger fatality . . . .

GREEN ENCYCLOPEDIA 285 (1st ed. 1992).

10. *See* EVAA Newsflash, *CARB Responds to Carnegie Mellon* (visited June 23, 1997) <http://www.dnai.com/~ev/newsflash/carb.html> [hereinafter EVAA Newsflash].

11. *See* Roland J. Hwang, *Electric Cars, Clean Air and the Latest Myth*, N.Y. TIMES, Sept. 3, 1996, at A14.

12. When HCs, their oxidation products, and NO_x combine a few hundred meters above our major cities, they react in the presence of sunlight to produce strongly oxidizing compounds, ozone being the most prevalent. *See* Calvert, *supra* note 1.

13. "Ozone" is a colorless, poisonous gas whose molecules each consist of three oxygen atoms. High in the atmosphere, the ozone forms the ozone layer, which helps protect life on earth from the harmful ultraviolet radiation of the sun. However, on the ground, ozone is an extraordinarily dangerous pollutant, irritating the eyes, nose, throat, and damaging the respiratory system. According to the Center for Disease Control, just one 14-ounce can of hair spray filled with pure ozone can kill approximately 14,000 people. *See* GREEN ENCYCLOPEDIA, *supra* note 9, at 231.

14. *See* Ronald J. Gregorio, *Success Obscured by Smog: The Regulation of Automobile Pollution*, 16.2 N.Y. ENVTL. L. 13 (May 1996) [hereinafter Gregorio].

15. "Oxidants" are substances which contain oxygen and readily make it "available for chemical reactions, which form new substances, as in the photochemical reaction that takes place in sunlight, and triggers the formation of smog." GREEN ENCYLOPEDIA *supra* note 9, at 236.

16. Calvert, *supra* note 1.

pain, coughing, nausea, and pulmonary congestion.[17] Based on epidemiological studies, the United States Environmental Protection Agency (EPA) has estimated that 15,000 people die annually from exposure to ozone-induced smog and particulate matter-induced soot.[18] Additionally, CO, even at moderate levels, can impair motor skills, and at higher levels, can significantly hamper the oxygen carrying capacity of blood,[19] reduce work capacity, cause poor learning ability and result in difficulty in performing complex tasks.[20] NO_x can irritate the lungs and lower resistance to respiratory infections such as influenza.[21] Studies have shown that these pollutants are potentially carcinogenic and may play a role in cancer-related health problems and cancer-causing deaths.[22] Therefore, effective control of vehicle emissions is the key to solving the largest part of the urban air pollution problem and to achieving acceptable air quality in the Nation.[23]

Although efforts in the past have been made to remedy the motor vehicle emissions problem,[24] the results have been less than satisfactory.[25] As a result, in 1990, Congress passed Title II of the Clean Air Act Amendments (Amendments).[26]

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17. *See* Christine Sansevero, *The Effect of the Clean Air Act on Environmental Quality: Air Quality Trends Overview*, 14.1 PACE ENVTL. L. REV. 31 (1996) [hereinafter Sansevero].

18. *See* John H. Cushman, Jr., *Clinton Toughens Air Pollution Rules*, N.Y. TIMES (June 26, 1997) <http://www.nytimes.com/yr/mo/day/news/washpol/clean-air.html>.

19. *See* Calvert, *supra* note 1.

20. *See* Sansevero, *supra* note 17.

21. *See id.*

22. *See* ENVIRONMENTAL AND OCCUPATIONAL MEDICINE 862 (1992).

23. *See* Calvert, *supra* note 1.

24. The automobile industry responded to strict congressional automobile-emission standards laws achieving a 96% reduction in tailpipe emission from 1968-1988. *See* Gregorio, *supra* note 14.

25. Due to the effect of emission from unregulated vehicles and the large increase in the number of miles driven, "automobile pollution has not been reduced by a corresponding 96% to 100% as measured in ambient air quality." *Id.* An EPA study shows that only one-third of automobiles have emission control devices that work properly. *See id.*

26. CAA Amendments of 1990, Pub. L. No. 101-549, 104 Stat. 2399 (1990).

B. The Clean Air Act[27]

Congress enacted the Clean Air Act (CAA)[28] in 1963 "to protect and enhance the quality of the Nation's air resources so as to promote the public health and welfare and the productive capacity of its population."[29] This promulgation was a result of congressional findings that "the growth in the amount and complexity of air pollution brought about by urbanization, industrial development, and increasing use of motor vehicles, has resulted in mounting dangers to the public health and welfare . . . ."[30] The fundamental goal of the CAA has not changed, notwithstanding the fact that it has been amended five times and the methods of attaining its goals have changed.[31]

C. The 1990 Amendments to Title II of the Clean Air Act

1. The 1990 Amendments

Congress most recently amended the CAA in 1990[32] in an effort to: (1) create more stringent air pollution standards;[33] (2) expand the scope of citizen suit enforcement actions;[34] (3) broaden the scope of liability by authorizing

27. CAA §§ 101-618, 42 U.S.C. §§ 7401-7671(q) (1996).

28. *See* S. REP. No. 228, at 1 (1990), *reprinted in* 1990 U.S.C.C.A.N. 3385, 3387.

29. CAA § 101(b)(1), 42 U.S.C. § 7401(b)(1).

30. *Id.* § 101(a)(2), 42 U.S.C. § 7401(a)(2).

31. *See* Anthony R. Wynne, *Sierra Club v. Public Service Company of Colorado: Judicial Amendment or Towards Continuous Compliance; Expanding the Scope of Citizen Suits and the 1990 Amendments to the Clean Air Act*, 14.1 PACE ENVTL. L. REV. 383, 385 (1996).

32. Clean Air Act of 1963, Pub. L. No. 101-549, 104 Stat. 2399 (1990), *amended by* CAA §§ 101-618, 42 U.S.C. §§ 7401-7671q (1996). On June 25, 1997, President Clinton approved the EPA's amendments to existing regulations under the CAA regarding the revision of the National Ambient Air Quality Standards for ozone and particulate matter. *See* Calvert, *supra* note 1. Although there was much opposition to these more stringent standards by industry groups concerned with resulting compliance costs, the President approved the new regulations specifically for the benefit of children of the United States. *See id.*

33. *See* WILLIAM H. RODGERS, JR., ENVIRONMENTAL LAW § 3.2 at 140 (2d ed. 1994).

34. *See* David T. Buente, *Citizen Suits and the Clean Air Act Amendments of 1990: Closing the Enforcement Loop*, 21 ENVTL. L. 2233 (1991).

penalties for past violations of the CAA;[35] and (4) include criminal penalties in addition to civil and administrative penalties.[36] The Amendments are the largest and most powerful part of the CAA.[37] Title II, which concerns mobile source emissions reduction, is relevant to this Comment.

2. The Title II Amendments

Title II of the CAA regulates motor vehicle tailpipe emissions in an attempt to effectively combat their harmful effects.[38] One method by which the Amendments achieve this goal is to require states to comply with stringent attainment schedules for the National Ambient Air Quality Standards (NAAQS).[39] There are two types of NAAQS: primary standards designed to protect human health and secondary standards designed to protect the public welfare.[40] The Administrator of the EPA, as authorized by section 108(a)(1) of the CAA, sets both types of NAAQS through regulations.[41]

In addition to setting the NAAQS, the federal government establishes the national automobile emission standards, thereby preempting state regulation.[42] However, because California, particularly the city of Los Angeles, has the worst air quality in the Nation,[43] and because the city was regulating its air pollution before the federal government established its emission standards, California is exempt from the national standards.[44] This waiver provision allows Cali-

35. *See* CAA § 113(a)(3), (d)(1)(a), (b), 42 U.S.C. § 7413(a)(3), (d)(1)(a), (b).

36. *See id.* § 113(c), 42 U.S.C. § 7413(c).

37. *See* David R. Wooley, CLEAN AIR ACT HANDBOOK: A PRACTICAL GUIDE TO COMPLIANCE 2-22 (5th ed. 1996) [hereinafter Wooley]. Professor Wooley is a Professor of Environmental and Energy Law at Pace University School of Law.

38. *See* CAA § 202, 42 U.S.C. § 7521.

39. *See id.* § 110(a), 42 U.S.C. § 7410(a).

40. *See id.* § 109(b)(1),(2), 42 U.S.C. § 7409(b)(1),(2).

41. *See id.* § 108(a)(1), 42 U.S.C. § 7408(a)(1).

42. *See id.* § 209(a), 42 U.S.C. § 7409(a). This section states in part: "No state or any political subdivision thereof shall adopt or attempt to enforce any standard relating to the control of emission from new motor vehicles . . . subject to this part." *Id.*

43. *See* Timothy Egan, *Urban Sprawl Strains Western States*, N.Y. TIMES, Dec. 29, 1996, at A1 [hereinafter Egan].

44. *See* CAA § 177, 42 U.S.C. § 7477. This section provides in part:

fornia to enforce more stringent emission standards in order to comply with the NAAQS. One method by which California complies with its emissions standards is to encourage the sale of EVs.[45]

D. California's Implementation Program and Its Impacts on Other States

1. The California Program

Under the CAA, each state has the responsibility to ensure that its air quality meets the NAAQS.[46] This is accomplished by the submission of a state implementation program (SIP) specifying the manner in which the state will fulfill its responsibility.[47] The Administrator of the EPA is authorized under section 107(c) of the CAA to designate areas as air quality control regions.[48] Accordingly, section 110 of the CAA requires that each state adopt and submit for approval to the Administrator of the EPA, "a plan which provides for implementation, maintenance, and enforcement of such primary [and secondary NAAQS] in each air quality control region within such state."[49] In an effort to assist California with NAAQS compliance, section 209(b)(1) of the CAA[50] provides a

> [A]ny State which has plan provisions approved under this part may adopt and enforce for any model year standards relating to control of emissions . . . if (1) such standards are identical to the California standards for which a waiver has been granted . . . and (2) California and such State adopt such standards at least two years before commencement of such model year . . . [No State shall] prohibit or limit . . . the manufacture or sale of a new motor vehicle or motor vehicle engine that is certified in California as meeting California standards, or to take any action of any kind to create, or have the effect of creating, a motor vehicle or motor vehicle engine different than a motor vehicle or engine certified in California under California standards (a "third vehicle") or otherwise create such a "third vehicle."

Id.

45. *See California: Quota on Zero-Emission Vehicle Sales Repealed by State Air Resources Board*, 26 ENV'T REP. 2301 (BNA) (Apr. 5, 1996).

46. CAA § 107(a), 42 U.S.C. § 7407(a).

47. *See id.*

48. *See id.* § 107(c), 42 U.S.C. § 7407(c).

49. *Id.* § 110(a)(1), 42 U.S.C. § 7410(a)(1).

50. Section 209(b)(1) of the CAA states in part:

waiver exemption for California to adopt new motor vehicle emission standards. California uses its own, more stringent vehicle emission standard in an effort to attain the NAAQS.

Under section 177 of the CAA, states can implement the stricter California standards rather than the more lenient federal standards.[51] Furthermore, section 177 prohibits the adopting state from limiting the sale or manufacture of a vehicle conforming to the California emission standards, in order to prevent the manufacturers and dealers of those vehicles that are specifically designed to meet the California standards from being unduly burdened.[52]

The California Air Resources Board (CARB),[53] in accordance with California's SIP, developed its low emission vehicle (LEV) program[54] which has recently been revamped. Originally, the only mandatory vehicle requirement was a ZEV sales quota of 2% imposed on dealers by 1998, 5% by 2001 and 10% by 2003.[55] However, in response to tremendous pressure from the automobile industry, on March 29, 1996,

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> The Administrator shall, after notice and opportunity for public hearing, waive application of this section to any State which has adopted standards . . . for the control of emissions from new motor vehicles . . . prior to March 30, 1966, if the State determines that the State standards will be, in the aggregate, at least as protective of public health and welfare as applicable Federal standards.

Id.

51. This is permissible as long as the state's adopted standards are identical to those of California and such standards are adopted at least two years before commencement of such model year. *See supra* note 44 and accompanying text.

52. *See id.*

53. CARB is the state's primary organization, under the California Environmental Protection Agency, for managing emissions and air pollutants, and for improving air quality throughout California. *See* CARB, CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY, ZERO EMISSION VEHICLES (1996).

54. The original LEV program created four classes of light and medium duty passenger vehicles to be phased-in over a ten year period: transitional low-emission vehicles (TLEVs), LEVs, ultra-low-emission vehicles (ULEVs), and ZEVs. *See* CAL. CODE REGS. tit. 13, § 1960.1(g)(1) (1995). Of these four categories, ZEVs were the only vehicles that manufacturers had to sell in accordance with a quota; hence the phrase "ZEV mandate." *See id.*

55. *See California EV Mandate Rolled Back; Justice Department Sets Antitrust Probe*, ELECTRIC UTIL. WK., Apr. 8, 1996, *available in* 1996 WL 8595814 [hereinafter *California EV Mandate Rolled Back*].

after a two-day public hearing, CARB unanimously decided to roll back the electric vehicle mandate by five years.[56]

The automobile manufacturers' argument against this mandate focused primarily on the lack of technology available for economically and environmentally viable EVs.[57] The automobile industry pleaded for more time "to develop advanced batteries capable of holding charges longer than current lead-acid batteries,[58] in order to ensure a viable market for electric vehicles."[59] The manufacturers believed that the limited range (traveling distance per charge) of EVs would not generate sufficient consumer demand, especially since EVs are more expensive than ICVs.[60] Thus, after CARB conducted several public meetings and workshops to assess the available long-range EV technology,[61] and over great opposi-

56. *See id.*

57. Telephone Interview with Carl Perry, Vice President of U.S. Electricar, Inc. (Oct. 28, 1996).

58. These lead-acid batteries afford the vehicle a range of approximately 100 miles on a single charge that fluctuates with the terrain and the weather conditions under which the EV is driven. *See* Lester B. Lave et al., *Environmental Implications of Electric Cars*, ENVTL. SCI. & TECH., May 19, 1995, *available in* 1996 WL 10025247 [hereinafter Lave].

59. *See California EV Mandate Rolled Back; Justice Department Sets Antitrust Probe*, *supra* note 55.

60. *See id.*

61. Governor Pete Wilson of California also had an independent scientific panel investigate the issue, and in October of 1995, they concluded that technology for long-range EVs would not be available on a large scale until after 2001. *See California: Air Resources Board Would Suspend Sales Quotas for ZEVs in 1998, 2001*, ENV'T REP. (BNA) (Jan. 5, 1996) [hereinafter *California: Air Resources Board Would Suspend Sales Quotas for ZEVs in 1998, 2001*].

tion from environmentalists,[62] CARB decided to eliminate the early-year mandates.[63]

Unlike its predecessor, the new ZEV rule is not a mandate requiring compliance with a sales quota, but an MOA between CARB and each of the Big Seven automakers.[64] It is a voluntary market-driven program designed to develop a commercial market for EVs by permitting automakers to determine the number of EVs to build based on consumer demand.[65]

The MOA requires both the automakers and CARB to perform certain obligations.[66] By 2001, manufacturers nationwide must produce cleaner vehicles by participating in the National LEV Program, also referred to as the "49 State Program."[67] If they do not participate in this program, "the manufacturers must offer equivalent emission reductions benefits for California."[68] Automakers must acquire the ca-

62. Environmentalists argued that CARB's decision to repeal the original mandate and move from an easily enforceable regulatory structure to a much more difficult to enforce agreement would be a setback for the development of EV programs around the Nation since the driving force of the auto industry's research and development would no longer be there. *See California EV Mandate Rolled Back*, *supra* note 55.

In fact, environmentalists have suspicions that there may have been a conspiracy by the auto industry to limit EV market development and restrict competition which ultimately affected CARB's decision. *See id.* At present, the Department of Justice (DOJ) is undergoing an investigation of the alleged violation as a result of a Sierra Club Legal Defense Fund complaint filed with the DOJ and the state Attorney Generals in California and Massachusetts in January of 1996, alleging this anti-competitive collusion by the oil and auto industries to destroy California's EV program in the hopes of derailing all such programs throughout the Nation. *See id.*

63. *See id.*

64. These auto manufacturers are Chrysler, Ford, General Motors (GM), Honda, Mazda, Nissan and Toyota. *See CARB Approves Relaxation of ZEV Production Quotas*, CAL. ENVTL. L. MONITOR, Apr. 15, 1996, *available in* LEXIS.

65. *See California EV Mandate Rolled Back*, *supra* note 55.

66. *See* Memorandum of Agreement of August 1996, between CARB and Ford Motor Company (on file with the *Pace Environmental Law Review*) [hereinafter Memorandum of Agreement].

67. The "49 State Program" is a voluntary program where manufacturers produce and deliver for sale cleaner light duty vehicles (vehicles certified to standards equal to California standards excluding states that have adopted the California program pursuant to section 177 of the CAA). *See id.*

68. *See id.*

pacity to produce a sufficient number of ZEVs for sale in California in order to meet the consumer demand.[69] Manufacturers must submit annual ZEV product plans to CARB for model years 1998 through 2003.[70] Furthermore, automakers must agree to make good faith efforts to promote and develop a market for ZEVs and to ensure ongoing ZEV-related research and development.[71] Moreover, manufacturers must file a report providing specific information within ninety days following the close of each calendar year.[72] Automakers are also required to continually collaborate with CARB and the state fire marshal to develop a comprehensive ZEV safety training program.[73] Finally, the manufacturers must provide CARB with an onsite review of the activities and hardware related to the manufacturers' ZEV program.[74]

To fulfill its obligations, CARB must work with state and local authorities to ensure the development of a ZEV infrastructure and to remove any barriers obstructing ZEV implementation.[75] Specifically, CARB must do the following: (1) facilitate the purchase of ZEVs for appropriate applications in state fleets to establish vehicle specifications for the "State Bid List"; (2) ensure the sale or lease of ZEVs to state agencies; (3) establish reasonable rates for insuring new ZEVs in order to promote insurance industry awareness of ZEVs and resolve any other ZEV insurance-related issues; (4) develop risk assessment data to assist in securing financing for the

69. *See id.* The specific number of ZEVs is confidential and proprietary business information and thus not available to the public at large.

70. *See id.* ZEV product plans must include, to the extent available, projections for model type(s), vehicle features and specifications, production capacity, capital allocation, prospective battery suppliers, and identification of products that will meet the ZEV regulatory requirement in the 2003 model. *See id.*

71. *See* Memorandum of Agreement, *supra* note 66.

72. *See id.* The annual reports must include information regarding: ZEVs placed in California and the United States, including the type and number of ZEV and the type of battery; the purchase of advanced technology batteries prior to 1998 and identification of the manufacturer's contribution during the year to the United States Advanced Battery Consortium program; and concerning the placement of ZEVs in demonstration projects. *See id.*

73. *See id.*

74. *See id.* The onsite review can be no later than three months prior to the required biennial review and shall be at a mutually agreeable time. *See id.*

75. *See id.*

purchase or lease of ZEVs; (5) help ensure the availability of sufficient battery recycling facilities; (6) help in planning and permitting quick charge and public charging stations; and (7) assist in providing electrical contractors with the proper training for installation and maintenance of charging systems.[76] CARB is also required to: (1) continue to support the efforts of the Infrastructure Working Council for the standardization of a power supply, conductive and inductive charging, and emergency disconnect systems; (2) create a comprehensive ZEV training program for state and local emergency response officials and towing companies to ensure preparedness for incidents involving ZEVs; (3) continue to observe the United States Advanced Battery Consortium's activities regarding the development of advanced technology batteries; and (4) support the development and implementation of reasonable incentive programs that improve the near-term marketability of ZEVs.[77]

If automakers fail to uphold the agreement, CARB has the authority to reinstate the old mandate as well as impose liquidated damage penalties of up to $100 million for breach of contract.[78] Ultimately, the MOA retains the original mandate's requirement that 10% of all new vehicles sold in California will be ZEVs by 2003.[79] Thus, under the old mandate, there would have been approximately 960,000 EVs in California by 2010, whereas under the new rule the number drops to approximately 800,000.[80]

In order to meet the MOA deadlines as well as the NAAQS, and due to the existence of doubt and skepticism

76. *See id.*

77. *See id.* Note that the MOA also provides for SIP credits and biennial public reviews of the ZEV program. The SIP credit provision states that if the manufacturer meets the current non-methane organic gas exhaust emission requirement and implements a 49 State Program, the emission reduction would be at least equal to the benefits derived from the 1998 to 2002 percentage ZEV requirements in the state's current SIP. *See id.* The review provision establishes that CARB will hold biennial public hearings, from 1998 until the MOA terminates in 2003, to conduct comprehensive reviews of the ZEV program and will include the status of battery technology. *See id.*

78. *See id. See also California EV Mandate Rolled Back*, *supra* note 55.

79. *See id.*

80. *See id.*

concerning the efficiency and economic and environmental benefits of EVs, both the government and automobile manufacturers have established incentives to encourage EV sales.[81] California, for example, has numerous incentives for both manufacturers and consumers.[82] For automakers, the state does the following: (1) authorizes financial assistance for projects involving the development and commercialization of EVs under the California Alternative Energy and Advanced Transportation Financing Authority Act (formerly titled the California Alternative Energy Source Financing Authority Act);[83] (2) designates 20% of its Employment Training Fund for special training projects regarding EV industry development;[84] (3) allows the South Coast Air Quality Management District to collect one dollar from the registration renewal fee of a motor vehicle in order to fund EV projects and initiatives;[85] and (4) allows diversion of up to $5 million of employment training funds in order to promote the development of an EV industry.[86]

For consumers, the state does the following: (1) allows use of high occupancy vehicle (HOV) lanes by EV drivers, regardless of the number of individuals in the vehicle;[87] (2) requires electric utilities to subsidize electricity rates for public electric rail in order to encourage technological development;[88] (3) requires CARB to maintain a program that cre-

81. The federal government implemented a 10% tax credit of up to $4000 for the purchase of, or conversion to, an EV. Moreover, there is a tax credit of up to $100,000 for the adoption of a refueling infrastructure. *See* Electric Transport Coalition, *State Laws and Regulations Impacting Electric Vehicles* (on file with the *Pace Environmental Law Review*) [hereinafter Electric Transport Coalition].

82. Note that the incentives listed herein are specifically for the promotion of ZEVs and do not include incentives promoting the sale of LEVs and ULEVs. *See id.*

83. *See id.*

84. *See id.*

85. *See id.*

86. *See id.*

87. *BAT & EV Industry Succeed in Getting Bill in California to Governor to Provide Car Pool Lane Access for Electric Cars*, PR NEWSWIRE, Sept. 6, 1996, *available in* LEXIS, State and Regional News [hereinafter *Governor to Provide Car Pool Lane Access for Electric Cars*].

88. *See* Electric Transport Coalition, *supra* note 81.

ates emission reduction credits by supplanting an EV with a light-duty vehicle;[89] (4) appropriates $7 million for the two-year "Quick Charge" ZEV Program that ends in 1998 and provides $5000 to each of the first 1200 EV purchasers in a particular community;[90] (5) allocates $1 million in state energy funds to match federal funds for energy conservation and development programs;[91] (6) requires the issuance of "Blue Sky" license plates for EVs in order to provide special parking privileges;[92] and (7) allows diversion of up to $5 million in employment training funds to encourage EV industry development.[93]

2. Other States

Notwithstanding great opposition from the automobile industry,[94] the Ozone Transport Commission (OTC),[95] the air quality commission for the Ozone Transport Region (OTR) of the Northeast,[96] officially adopted California's LEV plan on

89. *See id.*
90. *See id.*
91. *See id.*
92. *See id.*
93. *See id.*
94. For a detailed explanation of the pros and cons of the automobile industry's comparable plan (the "49 State Plan") which the EPA passed up for the OTC's LEV plan, *see* Tara A. Stanton, *The Battle Over the Electric Car: The Big Three vs. The Northeastern States*, 8 TUL. ENVTL. L.J. 553, 556 (1995) [hereinafter Stanton].
95. The Administrator created the OTC under the authority of section 176A(a) of the CAA in order to try and bring the area into compliance with the NAAQS for ozone. This section reads in part:

> Whenever . . . the Administrator has reason to believe that the interstate transport of air pollutants from one or more States contributes significantly to a violation of a national ambient air quality standard in one or more other States, the Administrator may establish . . . a transport region for such pollutant that includes such States . . . .

CAA § 176A(a), 42 U.S.C. § 7506a(a) (1996).
96. The OTR is comprised of the following states: Connecticut, Delaware, Maine, Massachusetts, Maryland, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, the District of Columbia, and the part of Virginia that is in the Consolidated Metropolitan Statistical Area. *See id* § 184(a), 42 U.S.C. § 7511c(a). The purpose of the OTR is to create an area "with a unifying goal of controlling air pollution." David Bennett, Note, *Zero Emission Vehicles: The Air Pollution Messiah? Northeastern States Mandate*

January 24, 1995[97] in an effort to bring nonattainment areas within OTR into compliance.[98] However, the OTC did not adopt the ZEV requirement under California's original LEV program which was in effect at that time. Instead, under the OTC LEV plan, each state decides whether or not to require ZEV production and sales within its borders.[99] Thus, pursuant to section 177 of the CAA, states can adopt a modified California LEV program without the ZEV mandate and either substitute their own ZEV provision or not provide a ZEV provision at all.

Although California has now replaced its ZEV mandate with an MOA, any state that decides to adopt the California standards will not be prohibited from implementing a mandate.[100] To date, New York and Massachusetts are the only states to have adopted the original California LEV plan with the mandatory ZEV provision.[101] However, Massachusetts recently followed California's lead by supplanting its ZEV mandate with an MOA.[102] New York, on the other hand, is holding strong to the ZEV mandate that is scheduled to take effect in 1998. As a result, on February 10, 1997, Ford, General Motors (GM) and Chrysler filed suit against New York to prevent the ZEV mandate from taking effect prior to the im-

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ZEVs Without Considering the Alternatives or Consequences, 20 WM. & MARY ENVTL. L. & POL'Y REV. 333, 344 (1996). The regional area aspect reduces the interstate conflicts and problems connected with pollution crossing state lines and allows the states to work together to reduce existing air pollution levels in the entire region. *See id.*

97. *See* Wooley, *supra* note 37, at 2-23.

98. Under section 171 of the CAA, a "nonattainment area" is "for any air pollutant, an area which is designated 'nonattainment' with respect to that pollutant" and its compliance with NAAQS. CAA § 171(2), 42 U.S.C. § 7601(2).

99. *See* 60 Fed. Reg. 4712, 4731 (1995).

100. *See N.Y., Mass. Keeping EV Sales Mandates, Negotiating With Auto Companies*, AIR/WATER POLLUTION REP.'S ENV'T WK., March 1, 1996, *available in* LEXIS, Newsletter database.

101. However, such approval did not come without a strong legal fight between the states and automobile manufacturers regarding the proffered SIPs. *See* Motor Vehicle Mfrs. Ass'n. of the United States, Inc. v. New York State Dep't of Envtl. Conservation, 810 F. Supp. 1331 (N.D.N.Y. 1993); *see also* American Petroleum Inst. v. Jorling, 710 F. Supp. 421 (N.D.N.Y. 1989).

102. *See* Christine L. Younger, *Automakers Gear Up to Challenge Massachusetts' New ZEV Requirements*, WEST's Legal News, Dec. 9, 1996, *available in* 1996 WL 699287.

plementation of California's mandate.[103] If the automakers win this suit, EV integration in New York could be postponed until 2003; however, this is not a strong possibility, as similar legal challenges by automakers have failed in the past.[104]

a. New York's and Massachusetts' Incentives

In order to comply with its SIP,[105] New York exempts the cost difference between an EV and related EV infrastructure and an ICV from retail sales tax.[106] Furthermore, New York City has purchased, as required by ordinance, a certain number of EVs for the city's use.[107] As a method of complying with its SIP,[108] Governor Weld of Massachusetts issued an executive order in June 1996, to accelerate the purchase of EVs for state use.[109]

b. Other States' Incentives

Although no other states have adopted the original California ZEV mandate provision, they have similar incentives as those previously mentioned.[110] Other states, whether members of the OTR or not, may adopt LEV programs with ZEV mandates, as long as they comply with the two-year re-

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103. *See* Andrew C. Revkin, *Automakers Sue New York for Requiring Electric Cars*, N.Y. TIMES, Feb. 12, 1997, *available in* 1997 WL 9704203404. The automakers claim that under the CAA, New York must revamp its ZEV program to make it identical to the California program. *See id.* By keeping its 1998 ZEV mandate, New York is violating section 177 of the CAA which prohibits the creation of a "third vehicle" as an alternative to a California or Federal vehicle. *See supra* notes 44-49 and accompanying text for an explanation of section 177 of the CAA.

104. Telephone Interview with Charles Garlow, Program Chairperson of the Electric Automobile Association in Washington D.C. (Feb. 12, 1997).

105. On May 28, 1992, New York adopted California's original LEV plan including the ZEV mandate. *See* N.Y. COMP. CODES R. & REGS. tit. 6, § 218 (1992). *See also* Stanton, *supra* note 94, at 558.

106. *See* Electric Transport Coalition, *supra* note 81.

107. *See id.*

108. On February 1, 1995, the EPA approved Massachusetts' revised SIP adopting California's original LEV program including the ZEV provision. *See* Wooley, *supra* note 37.

109. *See* Electric Transport Coalition, *supra* note 81.

110. *See id.*

quirement provision of section 177(2) of the CAA.[111] Vermont, for example, has already adopted a ZEV mandate requiring 2% of all cars sold in the state to be EVs within two years from the time that EV technology is capable of meeting certain requirements.[112]

E. Arguments For and Against the Electric Vehicle

1. Electric Vehicles Versus Internal Combustion Vehicles

EVs are battery powered[113] whereas ICVs burn fuel to produce power.[114] Thus, with EVs, tailpipe and evaporative emissions[115] are nonexistent, hence their categorization as "zero emission vehicles."[116] Even when factoring in the emis-

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111. *See* CAA § 177(2), 42 U.S.C. § 7507(2) (1996). This section provides in part:

> [A]ny State which has plan provisions approved under this part may adopt and enforce for any model year standards relating to control of emissions from new motor vehicles . . . if . . . (2) *California and such State adopt such standards at least two years before commencement of such model year* (as determined by regulations of the Administrator).

Id. (emphasis added).

112. *See Vermont: State Zero-Emission Vehicle Program Includes Specifications for Electric Cars*, DAILY ENV'T REP. (BNA) (Sept. 27, 1995) [hereinafter *Vermont: State Zero-Emission Vehicle Program Includes Specifications for Electric Cars*]. The EV must: (1) cost less than $19,000 (in 1995 dollars); (2) travel a minimum of 150 miles on one charge; (3) accelerate from zero to sixty mph in no more than fifteen seconds; and (4) be able to be recharged in no more than two hours. *See id.*

113. To date, battery-powered EVs are the only vehicles capable of meeting zero emission requirements. However, there is evidence that other vehicles, such as hybrid and fuel-cell-powered vehicles, may be able to meet zero emission requirements provided that their emissions are no higher than the power plant emissions associated with battery-powered EVs and that their emissions do not increase over time. *See* CARB, *Options for the Zero Emission Vehicle Requirement* (July 1996).

114. *See* NRDC, *supra* note 2.

115. Evaporative *emissions are emission* released directly by gasoline powered vehicles, in addition to tailpipe releases, which occur both while the vehicles are driven as well as when parked. *See* CARB, *Why Are Zero Emission Vehicles Needed?* (July 1996).

116. *See* Lave, *supra* note 58.

sions generated by power plants that produce the electricity to recharge the batteries, EVs are less polluting than ICVs.[117]

EVs are more than 90% less polluting than even the lowest emission producing vehicles.[118] Evaporative emissions, such as gasoline refinery emissions[119] and gas station emissions associated with pumping gas,[120] are elements of ICV production and operation and not found with EVs. Furthermore, unlike EVs, ICVs have emission control systems that unavoidably deteriorate over time causing the vehicles to exceed the emissions limit.[121]

EVs also help reduce noise pollution and promote energy efficiency. "[EVs] run extremely quietly and smoothly, and are more efficient than internal combustion engines . . . ."[122] One reason that EVs are more efficient than ICVs is because EVs only use their battery-powered engines when the accelerator is depressed and not when the vehicle is idle.[123] Moreover, EVs convert energy into power more rapidly than ICVs[124] because the process by which fuel is converted into energy in ICVs is much more complex.[125] Even the most efficient ICV gives the driver only fifteen cents on every dollar.[126] This amounts to eighty-five cents of every dollar of gasoline purchased being released into the environment as smoke and heat.[127] EVs, on the other hand, get approxi-

117. *See* NRDC, *supra* note 2. *See also*, EVAA Newsflash, *supra* note 10.

118. *See* CARB, *Why Are Zero Emission Vehicles Needed?* (July 1996).

119. *See id.*

120. *See id.*

121. *See id.*

122. *See* NRDC, *supra* note 2.

123. *See id.*

124. Telephone Interview with Peter Iwanowicz, Project Director of Air and Energy Issues, Environmental Advocates (Feb. 12, 1997).

125. *See* Philip H. Abelson, *Applications of Fuel Cells*, SCIENCE, June 22, 1990, at 1496. ICVs convert chemicals into heat energy and then into mechanical energy. With each of these conversions, there is a loss of energy resulting in only a 40% production of useful energy. *Id.* Batteries, on the other hand, convert chemical energy directly into electrical energy thereby bringing the output efficiency closer to 100%. *See id.*

126. *See 21st Century Just Can't Wait*, ECO-MOTION ELECTRIC CARS (June 23, 1997) <http://www.halcyon.com/slough/ecomotion>.

127. *See id.*

mately fifty-five cents on every dollar of electric charge.[128] This translates to more than a 300% energy efficiency advantage of EVs over ICVs, which indicates that EVs can travel much farther than comparable ICVs utilizing the same amount of energy.[129]

Although there is great debate surrounding the assertion that EVs are less polluting than ICVs, studies finding this proposition to be untrue have been proven flawed and therefore without merit.[130] In particular, researchers from Carnegie-Mellon University conducted highly controversial studies in 1995,[131] and again in 1996,[132] claiming that EVs provide no significant environmental or economic benefit. In the 1996 study, researchers alleged that EVs would actually have a negative effect on the environment because the discharges of lead from the power plants and from lead-acid battery disposal could more than offset the fact that EVs produce

128. *See id.*

129. *See* NRDC, *supra* note 2.

130. *See CTA Findings Reveal Carnegie-Mellon Study Misrepresents Environmental Impacts of Electric Vehicles*, *supra* note 7. These studies have been proven unreliable and perhaps even intentionally misleading. The May 19, 1995 study was found to contain erroneous quantitative data up to 1000 times greater than actual figures. *See id.* Much of the data used in the study is flawed and outdated and disregards significant advances in environmental protection covering lead processing and in improved battery technologies. *See id.* David Goldstein, president of Program Development Associates and founding member of the Electric Vehicle Industry Association, states "[s]eldom has a scientific study contained so many significant and embarrassing errors, contradictions and miscalculations." *Id.* at 4.

The interests of large automobile and oil companies are suspected of having influenced the 1995 Carnegie-Mellon study. It was funded, in part, by the National Science Foundation, and Ford Motor Company assisted in transferring the research results. *See id.* Support also came from the Green Design Consortium of the Carnegie-Mellon University Engineering Design Research Center where affiliates such as British Petroleum America, Exxon Research and Engineering, GM Delco Chassis, GM Packard Electric, Mobil R&D, Shell Development, Daimler-Benz and Motorola could give input on research direction and programs with access to Carnegie-Mellon University laboratories and feedback meetings. *See id. See also* EcoElectric Corporation, *Great EV Lead Hazard Hullabaloo Subsides: A 1997 Update* <http://www.fanfarehouse.com>.

131. *See* Lave, *supra* note 58.

132. *See New Carnegie-Mellon Study Again Raises Ire*, ELECTRIC VEHICLES ENERGY NETWORK, Sept. 9, 1996 [hereinafter *New Carnegie-Mellon Study Again Raises Ire*].

no tailpipe emissions.[133] This claim, however, is invalid. Medical studies have proven that lead-related health problems in children are the result of deteriorated lead paint in older buildings and urban soil and dust contaminated by past emissions of leaded gasoline,[134] sources that are unrelated to today's battery manufacturing facilities.

Admittedly, lead emissions remain a major concern for power plants, as well as battery manufacturing and recycling facilities that generate and handle lead. However, lead emissions at these facilities pose less of a threat today than ICV emissions because of the localization of lead production and the high rate of lead recycling.[135] The by-products of lead smelting are solid, inert materials that do not release particulate emissions unless openly combusted.[136] These by-products do not disintegrate or dissolve unless exposed to severe acid.[137] Any particulate emissions that might result from smelting are controlled at stationary plants[138] which would not be emitting any more lead than is already permitted by law.[139] As time progresses, power plants will be more heavily

133. *See id.*

134. *See Blood Lead Levels—United States, 1998-1991: CDC Editorial Note*, JAMA (Oct. 5, 1994).

135. *See CTA Findings Reveal Carnegie-Mellon Study Misrepresents Environmental Impacts of Electric Vehicles*, *supra* note 7.

136. *See id.* (citing David Goldstein, lead specialist, National Center for Environmental Assessment).

137. *See id.*

138. *See id.*

139. Fossil fuel utility plants, coal burning in particular, emit sulfur dioxide, NO_x, CO_2 and mercury. With sulfur dioxide, increased electricity generation would result in little or no increase in emissions due to the nationwide cap on the amount of sulfur dioxide that utility plants can emit. Telephone Interview with Dwight Alpern, EPA Acid Rain Division (Oct. 8, 1996). Under this cap, each plant is given an annual amount of sulfur dioxide that it can emit. *See id.* The cap is maintained under an emissions trading system where certain plants can buy the credit to exceed their limit from a plant that emits less than its annual amount. *See id.* Thus, if a plant emits its limit of sulfur dioxide and cannot purchase credits to emit more, then that plant cannot increase its coal burning amount, and the electricity for the EVs will have to come from another plant. *See id.*

The NO_x emissions are not regulated in the same way, and the CO_2 and mercury emissions are not federally regulated at this time. *See id.* NO_x is federally regulated under a rate-limit program instead of an amount-limit program. *See id.* As a result, a plant could be meeting the rate limit, even though

regulated to achieve compliance with NAAQS, especially in nonattainment areas.[140] Thus, while ICV emissions increase as their components deteriorate, EV-related emissions will decrease over time.[141]

Because the pollution from power plants that generate the electricity to power EVs is centralized, it is more easily and efficiently regulated than ICV pollution. Moreover, the mining, smelting and manufacturing of the batteries occurs at a limited number of plants across the Nation.[142] ICV pollution, on the other hand, is much more difficult to regulate and contain because it is produced by a millions of mobile sources.[143]

Another flaw of the Carnegie-Mellon studies is the assumption that all lead used to produce EV batteries will be unrecycled lead from primary sites.[144] Lead is the most recycled material used in society today.[145] In fact, 85% of the lead used in battery manufacturing is secondary lead from recycled batteries.[146] By using recycled lead, forty-five times

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its annual amount of NO_x emissions may be increasing as the amount of coal burned and electricity generated increase. *See id.*

140. Telephone Interview with Peter Iwanowicz, Project Director of Air and Energy Issues, Environmental Advocates (Feb. 12, 1997).

141. *Id.*

142. *See CTA Findings Reveal Carnegie-Mellon Study Misrepresents Environmental Impacts of Electric Vehicles, supra* note 7.

143. Telephone Interview with Peter Iwanowicz, Project Director of Air and Energy Issues, Environmental Advocates (Feb. 12, 1997).

144. All newly mined lead in the U.S. comes from only three primary lead mining operations: the Doe Run facility in Missouri, the Asarco facility in Montana and the Asarco facility in Missouri. *See CTA Findings Reveal Carnegie-Mellon Study Misrepresents Environmental Impacts of Electric Vehicles, supra* note 7. A United States Department of Health study of public exposure to lead in the vicinity of these primary smelting facilities found that up to 93% of participants in the study areas had blood lead levels that were less than the safe level of ten micrograms per deciliter as set by the Center for Disease Control. *See Multisite Lead and Cadmium Exposure Study with Biological Markers Inc.*, United States Department of Health and Human Services, Agency for Toxic Substances and Disease Registry (April 1995).

145. *See CTA Findings Reveal Carnegie-Mellon Study Misrepresents Environmental Impacts of Electric Vehicles, supra* note 7.

146. *See id.*

less lead is released than when newly mined lead is used.[147] As with all lead smelting facilities, lead recycling facilities are localized and highly regulated.[148] The EPA issued regulations in 1995, requiring secondary facilities to meet emission standards that reflect the maximum achievable control technology (MACT).[149] These regulations were designed to reduce secondary smelting facility emissions 70% more than the previous standards.[150] In southern California, the region with the worst air quality in the Nation, lead battery recycling facilities are located in areas that are in compliance with lead emissions.[151] In fact, these southern California facilities have not received any ambient air lead violations for years.[152] Furthermore, the actual number of secondary lead recycling facilities has dramatically decreased from fifty-six in 1978 to seventeen in 1995.[153]

Disposal of the lead-acid batteries is another issue that has been raised by EV opponents. However, EV batteries will likely be installed at the place of purchase or lease since they are installed in a "pack" of batteries that includes a tray with connectors and other related appurtenances.[154] Due to a high recycle value, it is highly improbable that any batteries would be outright discarded.[155] Battery lead should not leach

147. *See id.* at 7 (citing CARB, Letter from Tom Cackette to Lester Lave, June 5, 1995; Program Development Associates, Letter from David Goldstein to Science Magazine, May 19, 1995; Electric Vehicle Association of the Americas, *Technical Brief*, May 1995).

148. *See id.*

149. National Emission Standards for Hazardous Air Pollutants (NESHAP) from Secondary Lead Smelting, 60 Fed. Reg. 121 (1995). MACT standards reflect the greatest degree of reduction of hazardous air pollutant emissions achievable by the facilities. *See id.* In computing MACT standards, the cost of achieving the emission reduction, any non-air quality health and environmental impacts and energy requirements are considered. *See id.*

150. *See CTA Findings Reveal Carnegie-Mellon Study Misrepresents Environmental Impacts of Electric Vehicles*, *supra* note 7 (citing Gas Guzzler Campaign Statement, "Help Dispel EV Myths," May 26, 1995).

151. *See* EVAA Newsflash, *supra* note 10.

152. *See id.*

153. *See CTA Findings Reveal Carnegie-Mellon Study Misrepresents Environmental Impacts of Electric Vehicles*, *supra* note 7, at 8.

154. *See* EVAA Newsflash, *supra* note 10.

155. *See id.*

into the groundwater or become airborne if deposited in a proper hazardous waste facility.[156] The design of modern hazardous waste landfills, which require impermeable barriers to resist weathering and leaching of the wastes to groundwater below and through the overlying caps, will prevent this from occurring.[157]

The 1996 Carnegie-Mellon study also argued that the potential ozone-related benefits that EVs provide would be marginal and therefore not cost-effective.[158] However, CARB estimates that EVs using current lead-acid batteries would reduce pollution by 90-98% as compared to the cleanest gas burning vehicles.[159] Factoring in power plant emissions associated with recharging the batteries, EVs would reduce CO emission by virtually 100%, VOC emissions by 90%, NO_x emissions by 80%, and CO_2 emissions by 60%.[160] It has also been estimated that "[i]f 10% of every car sold in the northeast for the next ten years was an electric car, you would get an additional 18,000 tons of NO_x reductions" in this geographical area alone.[161]

Since no combustion processes occur during EV operation, the vehicles are not only less polluting[162] but inherently safer than ICVs. EVs, unlike ICVs, do not store gas or other liquids such as oils, antifreeze, and lubricants (vital elements needed to keep the numerous moving parts of ICVs functioning), most of which are highly flammable as well as toxic

156. *See id.*

157. *See id.*

158. *See New Carnegie-Mellon Study Again Raises Ire*, *supra* note 132.

159. *See* NRDC, *supra* note 2.

160. *See CTA Findings Reveal Carnegie-Mellon Study Misrepresents Environmental Impacts of Electric Vehicles*, *supra* note 7, at 5 (citing *Emission Benefits of Electric Vehicles in the Northeast*, Union of Concerned Scientists (July 1994)).

161. William Rosenberg, *The Clean Air Act Amendments and the Electric Utility Industry*, 14.1 PACE ENVTL. L. REV. 69 (1997).

162. As EVs replace ICVs, pollutant levels of hydrocarbon, ozone-forming nitrogen oxides, particulate matter, carbon monoxides and toxins such as benzene, butadiene, formaldehyde, and acetaldehyde emissions will deplete. *See* EVAA Newsflash, *supra* note 10. Additionally, the numerous liquid wastes associated with ICVs will be eliminated with EV use. *See* CARB, *Facts About Electric Vehicle Safety* (Apr. 1996) [hereinafter *Facts About Electric Vehicle Safety*].

when improperly exposed to the environment.[163] Additionally, lead-acid batteries will not spill acid because the major automakers will use a gel form that has the consistency of peanut butter.[164] Furthermore, the batteries will be sealed which will eliminate the hydrogen gas emissions that are associated with ICV batteries.[165] However, in the rare event that the battery case ruptures, only about one ounce of electrolyte would be released.[166] To the contrary, ICV batteries contain more than two quarts of liquid acid which can easily spill if a ruptured battery case occurs.[167]

EVs also have a lower center of gravity with a greater mass than ICVs, which makes EVs less prone to rollover in the case of an accident. If the EV should roll, there would be no danger of explosion since there is no gasoline or hydrogen within the vehicle. The fact that EVs eliminate gasoline use also reduces the hazards associated with the transport, storage and pumping of the fuel.[168]

Additionally, because no combustion processes occur in EVs, they do not produce any heat while in operation.[169] Therefore, EVs minimize the risk of fire, as well as passenger

163. *See id.*

164. *See id.*

165. *See id.*

166. *See id.*

167. *See id.*

168. Hazards include gasoline and oil leakages and spills from accidents involving vehicles that haul the fuel on public roads and highways as well as simple storage of the substances at regulated or unregulated facilities. The run-off from these spills causes surface as well as groundwater and soil contamination which not only threatens those life-sustaining natural resources but human health and welfare as well.

A current example of such a situation can be found in Kennedy Heights, Texas, where an entire community has been struck full force with life-threatening diseases, allegedly from crude oil contamination of their soil and water. *See* Anita Manning, *Environmental Racism Suit Makes Waves*, USA TODAY, July 31, 1997, at 1D. The alleged cause of the oil contamination is the abandoned oil pits that Chevron now owns after having purchased Gulf Oil in 1985. *See id.* Approximately 1800 residents of Kennedy Heights are now suing Chevron, USA for an estimated $500 million due to the seventeen cases of lupus, three birth defects and thirty-five brain tumors and cancers the inhabitants have suffered likely due to the contaminated water. *See id.*

169. *See Facts About Electric Vehicle Safety, supra* note 162.

burning and scalding under any conditions.[170] Furthermore, heat, as exuded by ICV tailpipe emissions, exacerbates the greenhouse effect[171] and global warming.[172] In order to help prevent further global warming, the greenhouse effect must be prevented by reducing the production of greenhouse gases.[173] Since ICVs are the number one source of greenhouse gases, shifting from fossil fuels to renewable resources, such as battery power, would be environmentally beneficial.[174]

In addition to environmental benefits, the switch from reliance on oil and natural gas energy sources to a renewable source would give Americans energy independence. With this independence would come large scale savings in domestic drilling, foreign imports and national defense costs. Americans use seventeen million barrels of oil per day, and as a result, the Nation's oil supply is dwindling.[175] A similar fate will eventually befall the world supply.[176] Since 1980, United States domestic oil and gas production has decreased dramatically as American companies rely on international sources to supply the United States with these energy sources.[177] Existing domestic oil reserves are either too difficult and expensive to reach, or are located on federally protected public

170. *See id.*

171. The "greenhouse effect" is the warming that takes place when heat is retained near the Earth rather than escaping into outer space. *See* GREEN ENCYCLOPEDIA, *supra* note 9, at 152.

172. "Global warming" is a long term rise in the average temperature of the Earth. *See id.* at 142. Effects, such as a rise in sea levels causing islands and coasts to become submerged or swamped whereby shifting the ranges of plants and animals resulting in loss of biodiversity and threatening the existence of already endangered species, would be disastrous and very costly to humans. *See id.* at 143.

173. The greenhouse gases are CO, CO_2, methane, VOCs, NO_x, chloroflourocarbons and surface O_3. *See id.* at 152.

174. *See id.* at 146. Solar energy is also a possible alternative to fossil fuels. Nuclear energy is not a viable substitute since it causes other severe environmental problems. *See id.*

175. *See* Jack Huggins, *Renewable Fuels & U.S. Energy Policy*, Congressional Testimony by Federal Document Clearing House, Oct. 2, 1996 [hereinafter Huggins].

176. *See id.*

177. *See id.*

lands which cannot be drilled.[178] In this decade, imported oil and finished petroleum products represent more than one-half of the Nation's total domestic energy use.[179] The United States presently spends more than $63 billion a year to maintain its oil imports.[180] This figure amounts to one-fifth of the Nation's defense budget.[181]

Regardless of whether oil is imported or domestic, supplies will run dry, as the United States is only one of numerous countries competing for Saudi Arabian and South American oil and gas. China, for example, has gone from exporting 500,000 barrels of oil daily in 1990 to importing 300,000 barrels daily in 1995.[182] Furthermore, it is estimated that if China were to use as much oil per person as is used in the United States, it would require eighty million barrels per day to meet the needs of its entire population.[183] This is more than the whole world now produces or is ever projected to produce.[184]

The transportation industry is most responsible for the increase in oil consumption.[185] More than 95% of energy from transportation in the United States is petroleum-based.[186] Therefore, efforts to reduce the Nation's perpetual dependence on imported petroleum must target the transportation industry.[187] EVs, unlike ICVs, require no petroleum products in order to function properly.[188]

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178. *See* Denise A. Bode, *Energy Policy*, Congressional Testimony by Federal Document Clearing House, Mar. 21, 1996. For example, oil located beneath salt sheets would require drilling 15,000 to 20,000 feet at a cost of between $8 million and $20 million per well. *See id.*

179. *See* Huggins, *supra* note 175.

180. *See id.* Presently, the United States imports more than one-half of its oil. *See id.*

181. *See id.*

182. *See id.*

183. *See id.*

184. *See id.*

185. *See id.*

186. *See id.*

187. *See id.*

188. *See supra* notes 113-14 and accompanying text.

2. The Argument Against Electric Vehicles

The argument against EVs is an outgrowth of the argument against requiring EV implementation by way of legislative mandates—there is insufficient technology and infrastructure to make them marketable at this time.[189] The manufacturers' adamant argument against EV mandates is that mandates may force the introduction of EVs that are not as technologically sound or convenient as ICVs, preventing consumer interest in EVs.[190] This, in turn, would set the EV market back years, because manufacturers would have wasted valuable research and development time.[191]

EVs have been criticized primarily for their elevated purchase price, poor performance from limited battery technology, doubtful environmental benefits,[192] as well as inadequate technology and infrastructure for marketing in the near future.[193] The initial costs associated with the purchase of an EVs are higher than for a comparable ICV.[194] However, EV proponents argue that governments' and manufacturers' cash and tax credit incentives, combined with the time that can be saved by using EVs,[195] may compensate for their ele-

189. *See California: State Air Resources Board Seeking Flexibility In Mandate for Zero-Emission Vehicles*, ENV'T REP. (BNA) (Nov. 25, 1995); Telephone Interview with Mark Simon, NYC Department of Environmental Protection (Oct. 29, 1996).

190. *See Utilities Should Become More Active in EV Market, Group Told*, ENERGY REP., Apr. 17, 1995, *available in* LEXIS, Newsletter database [hereinafter *Utilities Should Become More Active in EV Market*].

191. *See id.*

192. *See* Lave, *supra* note 58. *See also* Wendy Weirauch, *Zero Emission Vehicle Acceptance 'Faces Obstacles'*, HYDROCARBON PROCESSING, Feb. 1, 1995.

193. Telephone Interview with Max Gates, American Automobile Manufacturers Ass'n (Oct. 29, 1996).

194. For example, GM's EV-1, a two-door sports car, has an estimated price of $35,000—$10,000 more than a comparable ICV. Telephone Interview with Carl Perry, Vice President of U.S. Electricar, Inc. (Oct. 28, 1996). *See also Case for Charging Ahead With Electric Vehicles in Southern California*, CAL. ENVTL. L. MONITOR, Feb. 19, 1996, *available in* LEXIS [hereinafter *Case for Charging Ahead With Electric Vehicles in Southern California*].

195. An EV can save the driver time through the use of HOV lanes. *See supra* note 87 and accompanying text. An EV also eliminates frequent gas station stops. *See* NRDC, *supra* note 2.

vated purchase price.[196] Additionally, the cost of EV maintenance and repair is virtually nonexistent since the vehicles have fewer moving parts than ICVs.[197] EVs, unlike ICVs, do not require oil changes, tune-ups, smog checks, or mandatory annual emission inspections.[198] Furthermore, the cost to charge EVs as opposed to the cost to fuel ICVs may offset the inflated purchase price of EVs. Today, gasoline costs anywhere from $1.10 to $1.70 per gallon; however, it costs only fifteen cents per night to recharge an EV if recharged at home during off-peak hours.[199] One potential EV customer in California calculated that a daily home charge of GM's EV-1[200] would cost him $16 per month as opposed to $60 per month which he currently spends on gasoline for his ICV.[201] A current EV-1 owner estimated that he will spend $489 to power his EV for three years, thereby saving himself approximately $7100—the cost to power his Chevrolet truck for that same amount of time.[202]

Recharging is free for public employees at certain utility plants that offer gratuitous EV hookups as an incentive for sales and use.[203] It is expected that for at least the first few years of EV integration, public chargers will not be metered and recharges will be free for all EVs.[204] This will reduce the cost of recharging considerably, thereby making EVs potentially more economical than ICVs, even during the initial in-

196. *See Governor to Provide Car Pool Lane Access for Electric Cars, supra* note 87.

197. *See* CARB, *"Fully Charged" About Electric Vehicles* (April 1996).

198. *See id.*

199. Interview with a GM EV-1 salesperson, Saturn dealership, Phoenix, AZ (Dec. 27, 1996). All EV owners and renters must have a recharging system installed in their homes. *See id.* The installation is free, and the minimal cost of its use is included in the homeowner's electric bill. *See id.*

200. The EV-1 is a GM production which is now available only for lease through select Saturn dealerships in Arizona and California. *See id.*

201. *See* Andrea Adelson, *Not One of Your Big Jump-Starts - GM is Trying to Make a Go of Its Electric Car*, N. Y. TIMES, May 7, 1997, at D4 [hereinafter *GM is Trying to Make a Go of Its Electric Car*].

202. *See id.*

203. *See id.*

204. *See id.*

tegration process when new products are typically more expensive.[205]

Many EV studies have exaggerated the costs associated with the initial purchase of an EV. According to one study, the price of an EV can range from $15,000 to $45,000 and that the Big Three American automobile manufacturers overstated the potential cost of an EV.[206] In fact, Peugot makes an EV which costs between $14,000 and $16,000.[207] Automobile manufacturers further alleged that the price of ICVs would necessarily inflate by $2000 in order to compensate for the projected cost of an EV.[208] However, there is opposition to this assertion as well.[209]

In particular, CARB asserts that, as with the introduction of any new technology, initial low production and research and development costs will result in EVs that are more expensive than comparable ICVs.[210] However, as in the cases of calculators, VCRs, and computers, the initial cost of EVs is expected to decrease dramatically once they become more widely accepted.[211] The introduction of more advanced EVs will attract a broader domestic and international market and will increase EV production and sales. This will allow manufacturers to spread their costs over more EVs, which will, in turn, result in lower EV purchase prices.[212]

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205. *See infra* notes 210-212 and accompanying text.

206. In fact, the Big Three originally estimated that EVs would cost more than $100,000 each to manufacture. *See Air Pollution: Drop in Electric Car Prices Will Occur During Next Few Years, Researchers Say*, ENV'T REP. (BNA) (Nov. 11, 1994) [hereinafter *Drop in Electric Car Prices Will Occur During Next Few Years, Researchers Say*].

207. *See Vermont: State Zero-Emission Vehicle Program Includes Specifications for Electric Cars*, *supra* note 112.

208. *See Drop in Electric Car Prices Will Occur During Next Few Years, Researchers Say*, *supra* note 206.

209. *See Case For Charging Ahead With Electric Vehicles in Southern California*, *supra* note 194.

210. *See* CARB, *The California Zero Emission Vehicle Program* (July 1996).

211. *See id.* Microcomputer prices decreased over 60% between 1990 and 1994 alone. *See id.* The cost of air bags decreased from $1200 in 1989 to $550 in 1992. *See id.* In full volume production, the cost of air bags is expected to decrease to $250, which is far below the estimated cost of $500 to $600 that was projected in the late 1980s. *See id.*

212. *See id.*

Inefficient battery technology is another argument against EV integration. Critics argue that the only sufficient EV battery technology existing today is the lead-acid battery which has a limited range of up to 100 miles per charge.[213] This range decreases when additional energy is drained by the heater, air conditioner, radio and headlights.[214] The existing lead-acid battery technology is ideal for delivery vehicles because they have daily routine courses, short distances to travel, and a few of them can be recharged simultaneously at the company's location after business hours.[215] However, due to the EV's limited range, individual consumers will most likely purchase an EV as a second vehicle to use only for short, predictable distances.[216] The limited range prevents a sizeable percentage of consumers from switching from an ICV to an EV altogether.[217] EV supporters argue that this allegation is unfounded. In Los Angeles, California, the average daily miles traveled by a commuter is thirty-eight; other cities have reported numbers less than twenty-eight daily miles.[218] If one-half of all drivers drive less than forty miles daily and current EVs have ranges from sixty to 100 miles per charge, there should not be such a strong emphasis placed on the limited range of EVs.[219] However, increasing the range of EVs is necessary for the eventual supplantation of ICVs.

Moreover, the lead-acid battery is only an interim technology which will eventually be replaced by more efficient battery technology in order to produce EVs with greater

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213. *See* Lave, *supra* note 58.

214. *See id.*

215. Telephone Interview with Max Gates, American Automobile Manufacturers Ass'n (Oct. 29, 1996).

216. *Id. See also* Telephone Interview with EV-1 salesperson, Saturn Dealership, Phoenix, AZ (Dec. 27, 1996). GM's EV-1, the Nation's first ZEV available to the public, has a range of approximately seventy-nine miles combined city and highway driving when fully changed. *See* Saturn EV-1 information pamphlet (on file with *Pace Environmental Law Review*) [hereinafter Saturn EV-1 information pamphlet].

217. *See GM Is Trying to Make a Go Of Its Electric Car*, *supra* note 201.

218. *The 21st Century Just Can't Wait*, ECO-MOTION ELECTRIC CARS (June 23, 1997) <http://www.halcyon.com/slough/ecomotion>.

219. *See id.*

ranges.[220] The United States Advanced Battery Consortium, in conjunction with the Electric Power Research Institute, United States Department of Energy and selected battery manufacturers, has committed over $260 million toward EV battery research and development since 1991.[221] The Advanced Battery Consortium lists more than ten batteries, aside from the lead-acid type, that are presently being developed and improved with a greater range than current lead-acid batteries.[222]

Lead-acid batteries are the most commonly used EV batteries, however, it is reported that none of the major automobile manufacturers are planning to continue to employ lead-acid batteries to power their EVs.[223] For example, GM's EV1 is currently powered by a lead-acid battery, yet the company anticipates a change to nickel-metal hydride in upcoming model years.[224] Honda and Toyota also intend to power their EVs with nickel-metal hydride batteries,[225] while Nissan plans to power its EVs with lithium-ion batteries.[226] Both nickel-metal hydride and lithium-ion batteries have ranges that far exceed those of lead-acid batteries.[227] For example, Toyota's nickel-metal hydride battery-powered EV is able to travel 240 miles on one charge.[228] The Solectra Sunrise currently holds the EV range record of 375 miles on a single charge.[229]

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220. Alternative technologies include vehicles powered by nickel-metal-hydride, zinc-air, fuel cells, plastic lithium-ion batteries, and solar power. *See New Carnegie-Mellon Study Again Raises Ire*, *supra* note 132.

221. *See CTA Findings Reveal Carnegie-Mellon Study Misrepresents Environmental Impacts of Electric Vehicles*, *supra* note 7.

222. *See id.* The eleven battery types are aluminum-air, lithium-ion disulfide, lithium-polymer, nickel cadmium, nickel-ion, nickel-metal hydride, nickel-zinc, sodium-sulfur, vanadium redox, zinc-air, and zinc-bromine. *See id.*

223. *See* EVAA Newsflash, *supra* note 10.

224. *See id.*

225. *See id.*

226. *See id.*

227. *See id.*

228. *See Vermont: State Zero-Emission Vehicle Program Includes Specifications for Electric Cars*, *supra* note 112.

229. *See* NRDC, *supra* note 2.

The final argument against EVs focuses on the lack of the necessary infrastructure for EV production and use. An infrastructure must be in place before EVs can become a familiar sight on roads throughout the Nation.[230] The elements necessary for a proper EV infrastructure that do not currently exist are: (1) the means for convenient and speedy recharges both in the home, on roadsides, and at utility plants;[231] (2) the ease of repair (including the existence of mechanics who are trained to work with EV dynamics); and (3) emergency medical teams specifically trained to deal with accidents involving EVs.[232] Some elements of infrastructure are already in place and more are being developed.[233] Moreover, technological improvements are constantly taking place.[234] However, EV opponents argue that more incentives are needed in order to develop a marketable EV transportation system.[235]

One way to develop a sufficient infrastructure is through cooperation between large cities and local electric utility companies.[236] If both utilities and government make a concerted

230. *See Kray Offers Study Suggesting Path for Future of Electric Transport*, ELECTRIC VEHICLES ENERGY NETWORK, June 26, 1995, *available in* LEXIS, Newsletter database [hereinafter *Kray Offers Study Suggesting Path for Future of Electric Transport*].

231. *See id.* GM's EV-1, the Nation's first ZEV, requires three hours to fully charge using a 220-volt home charger and fifteen hours using the portable 110-volt self-charger that comes with the vehicle. *See* Saturn EV-1 information pamphlet, *supra* note 216.

232. Telephone Interview with Max Gates, American Automobile Manufacturers Assn. (Oct. 29, 1996).

233. Public recharging stations are being constructed near malls and restaurants, places where drivers spend time for the sixty minutes presently needed for an 80% recharge of an EV. *See GM is Trying to Make a Go of its Electric Car*, *supra* note 201. As of the Spring of 1997, there were forty-seven such stations in California and twenty-two in Arizona, the two states with the most number of EVs to date. *See id.* Smog regulators are supposed to help pay for building another 150 sites in California by the end of 1997, while GM agreed in May of 1997 to underwrite an additional fifty sites in Southern California before the end of the summer. *See id.*

234. For example, Solectra car company EVs can be recharged in one hour as opposed to three hours. *See Vermont: State Zero-Emission Vehicle Program Includes Specifications for Electric Cars*, *supra* note 112.

235. *See Kray Offers Study Suggesting Path for Future of Electric Transport*, *supra* note 230.

236. *See id.*

effort to showcase EVs through personal use, they can help push the market toward EV integration.[237] This market push is already occurring in certain areas of New York and Connecticut where public schools are using electric buses.[238] In addition to offering cash incentives, both utilities and governments, by using EVs in their fleets, can demonstrate EV efficiency and reliability to the public, thereby fostering EV-demand.[239]

III. Analysis

A. Why Electric Vehicles Are Necessary

EVs are the key to cleaner air in the mobile air pollution arena because they have no tailpipe or evaporative emissions. This is a huge advantage for air quality improvement and general public health and welfare since these emissions are responsible for a majority of air pollutants in urban areas today.[240] This is compounded by the fact that urban populations are growing at such a tremendous rate.[241] The fundamental issue surrounding the use of EVs was whether they actually prevent air pollution or simply relocate it from tailpipes to the electric utility power plants; however, this issue is settled.[242] The fact is that even when accounting for utility plant emissions, EVs are over 90% cleaner than the least polluting ICVs.[243] Today, the most relevant question surrounding EVs is how to most effectively implement this new transportation technology. In other words, should states force the manufacturers to sell a certain percentage of EVs by a specific date, should the market demand determine the rate of EV integration, or should the manufacturers be able to choose how and when, if ever, to produce the vehicles for sale?

EV integration must become widespread so that the United States can effectively shift its energy reliance from

237. *See Utilities Should Become More Active in EV Market, supra* note 190.
238. *See id.*
239. *See id.*
240. *See supra* notes 9-23 and accompanying text.
241. *See* Egan, *supra* note 43.
242. *See supra* notes 113-74 and accompanying text.
243. *See supra* note 118 and accompanying text.

nonrenewable to renewable sources. Oil and natural gas will one day cease to exist. When this occurs, what will be relied upon for energy? It is illogical to wait until all reserves have been depleted before a shift toward renewable resources is undertaken, especially when a more environmentally and economically sound alternative is presently available.

As communities around the world increase their reliance on automobiles, the use of oil and natural gas increases. High demand for a scarce resource results in competition for the available supply. The fact that the United States imports more than one-half of its oil[244] creates a heavy reliance on oil-exporting countries. Thus, when an oil-exporting country experiences difficulties, the United States is naturally affected. For example, the United States' involvement in the Persian Gulf War was, in part, a result of imminent threats of losing oil imports from the Middle East. Moreover, the national deficit could be cut by more than $63 billion each year if the Nation's energy sources were shifted from oil to battery.[245] This translates into a tremendous cut in costs for the American public.

Because over 95% of the United States' transportation energy is petroleum based,[246] EV integration is the most effective way to begin a shift toward nonrenewable energy sources. EVs do not use gas, oil or any type of lubricating grease (since few parts move). There are no oil changes or gas station stops associated with EV use. There is no question that EVs are the solution to many of the United States' environmental and economic problems. Only one question remains—what is the most logical and effective method to integrate EVs into society?

B. MOAs Versus Mandates and *Laissez Faire*

The use of MOAs is the most economically and technologically efficient way to integrate EVs into the market. Agreements that require automobile manufacturers to produce EVs

244. *See supra* note 180.
245. *See supra* note 180 and accompanying text.
246. *See supra* note 186 and accompanying text.

according to the market demand are more beneficial to the environment and societal health than either forcing the technology prematurely through mandates or not requiring it at all, the *laissez faire* approach. MOAs remove the pressure of complying with mandated sales quotas from the automakers, but subject them to certain pressures, such as large fines and denial of vehicle sales certification for the failure to uphold their obligations under the contractual agreements.

MOAs are the most feasible and efficient method for successful EV integration because they require the state and automobile manufacturers to work cooperatively to ensure successful results.[247] Manufacturers fear that an immediate ZEV mandated sales quota would potentially poison the market, thereby causing projected EV benefits to backfire in the long run.[248] This is a very real possibility. With MOA EV implementation, the environmental effects may appear later than if immediate mandates were employed. However, by forcing integration with mandates, there is a realistic possibility that EV implementation will fail altogether if integration is forced to occur prematurely.

Under immediate-action mandates, consumer interest would likely be insufficient for successful EV integration if present EV technology was the only ZEV option available. EV proponents admit that the EV-1, the United States' first ZEV available to the public, is only functional as a second or third vehicle in a household. The EV-1 is comparable to an ICV in its smooth ride, sporty look, zero to sixty miles-per-hour acceleration in less than nine seconds, and quiet computer-like hum while in motion. However, present lead-acid batteries limit the EV-1's driving range between charges to approximately seventy-nine miles of combined city and highway driving.[249] Furthermore, it takes three hours to completely charge the vehicle using a 220-volt home charger and fifteen hours employing the portable 110-volt charger which is stored in the car's trunk when not in use.[250]

247. *See supra* notes 66-77 and accompanying text.
248. *See supra* notes 190-91 and accompanying text.
249. *See supra* notes 213-14, 219 and accompanying text.
250. *See supra* note 231.

The lack of sufficient EV infrastructure is another reason why EVs should not be mandated by state governments. Although EV infrastructure is becoming more advanced, it is insufficient for mandated EV integration. There are electric utility plants that offer EV recharging at no cost to the driver, and each EV owner or renter has a home charger.[251] What is lacking are widespread charging stations located off highways and other well-traveled roads and abutting public areas such as shopping malls and restaurants.[252]

Unlike mandates, MOAs assist in establishing an EV infrastructure by requiring EV programs to ensure preparedness for accidents involving EVs, such as the training of emergency response officials, including law enforcement officers, emergency medical technicians and firefighters, and the training of towing companies.[253] Simply because special training is required of all individuals associated with EV production, maintenance and use, it cannot be accurately asserted that EVs are more dangerous than ICVs. In fact, EVs are inherently safer than ICVs.[254] Thus, it is only a question of time before the proper training and the elements of a full-scale infrastructure are in place. Once these elements exist and advanced battery technologies are placed in the stream of commerce, EVs will be ready for widespread integration. However, at this time, EV technology and infrastructure are not mature enough for a mandated sales quota requiring immediate large-scale EV integration.

The *laissez faire* approach to EV integration would allow automakers to introduce EVs at their own discretion. This method of implementation would inevitably fail because automakers need to be pushed, at least to some degree, in order to introduce a technology that is new to the general public. Contractual agreements between each of the Big

251. *See supra* notes 199, 203-04 and accompanying text.

252. *See supra* note 233 and accompanying text. It is true that some areas, such as in California and Arizona, have begun to install recharging stations in such public areas. Nonetheless, there are still not sufficient stations to support extensive EV integration at this time.

253. *See supra* notes 77, 232 and accompanying text.

254. *See supra* notes 163-70 and accompanying text.

Seven automakers and state governments for the production and sale of EVs in that state, based on an amount determined by market demand, allow the automakers to provide EVs if economically beneficial, and not to provide them if unprofitable. This would not occur if the *laissez faire* approach was used.

This notion is supported by the fact that the automobile industry has a longstanding relationship with the oil industry and other industries adamantly opposed to EV supplantation of ICVs.[255] Furthermore, as evidenced by the early stages of an ongoing Department of Justice investigation, the automobile and oil industries may have attempted to derail the EV program in this country.[256] Allegations were also made in opposition to the researchers and authors of the Carnegie-Mellon studies charging that the studies are tainted because they were funded and supported by automobile manufacturers and research and development sectors of large oil companies, such as Exxon, Shell and Mobil.[257]

This information, in conjunction with the amount of research and development necessary to make EVs comparable to ICVs, exemplifies why the *laissez faire* approach would not produce any near-term EV benefits. Therefore, MOAs provide the necessary incentives so that manufacturers, despite their adamant resistance, will produce EVs that surpass their ICV counterparts in efficiency and convenience.

C. The Cost of Electric Vehicles: Soothing the Critics' Concerns

At first glance, the initial purchase and lease prices of EVs seem to support the hypothesis that immediate mandatory EV integration is inappropriate and potentially

255. *See California: Air Resources Board Would Suspend Sales Quotas for ZEVs in 1998, 2001*, *supra* note 61. *See also Air Pollution: Lead Threat From Electric Vehicles Exaggerated by Report, Center Says*, ENV'T REP. (BNA) (Nov. 24, 1995).

256. *See supra* note 62.

257. *See supra* note 130 and accompanying text. *See also Air Pollution: Lead Threat From Electric Vehicles Exaggerated by Report, Center Says*, ENV'T REP. (BNA) (Nov. 24, 1995).

damaging in the long-run. Consumers will most likely bypass purchasing current EVs until the vehicles become more widespread and less expensive. However, when all factors are considered, the overall cost of an EV is comparable to that of an ICV. Manufacturers' and governments' cash-back and tax credit incentives will help defray the cost of EVs. Additionally, the federal government provides a 10% tax credit of up to $4000 toward the purchase of, or conversion to, an EV.[258] Moreover, state incentives vary from one state to the next. A common method of providing incentives involves governmental funding of numerous EV projects as well as research and development programs.[259] Some states, like New York, exempt the cost differential for the EV and its related infrastructure from the EV retail sales tax.[260] Furthermore, manufacturers receive government funding for their EV programs, which allows them to offer cash back rebates for purchases or leases.[261]

The initial cost of an EV can also be offset by the low maintenance costs associated with the vehicle. EVs are inherently simpler than ICVs because they have fewer moving parts, which means that there are fewer moving parts to maintain and fewer to repair should malfunction occur. As a result, EVs have been projected to last longer than comparable ICVs.

The cost of refueling an ICV far surpasses the cost of recharging an EV. It can cost anywhere from $10 to $30 to fill an ICV gas tank depending upon the size and make of the vehicle. However, it costs only fifteen cents to fully charge an EV if it is charged at home during off-peak hours.[262] Although the fully fueled ICV can drive up to 350 miles before refueling, the battery technology to match this range already exists and will eventually be available to consum-

258. *See supra* note 81.

259. *See supra* notes 81-93, 105-12 and accompanying text.

260. *See supra* note 106 and accompanying text. Note that "related infrastructure" refers to such EV necessities as the EV home battery charging system that must be installed in an EV owner's home. *See supra* note 199.

261. *See supra* note 81 and accompanying text.

262. *See supra* note 199 and accompanying text.

ers.[263] The perpetual gas station stop, like the oil change, tune-up, smog check and inspection, will not be a part of an EV owner's life. In this respect, EVs will undoubtedly save owners time and money.

D. Other Electric Vehicle Implementation Options

The focus of this Comment has been MOAs and mandates—the primary implementation techniques used by states that integrate ZEVs under their clean air regulations. However, other plausible options do exist. For example, the market-based approach of the MOA could feasibly be combined with the commandeering approach of the mandate. Vermont has already implemented this technique, whereby automakers will be required to produce a certain number of ZEVs in the state once EV technology meets certain state requirements.[264] This hybrid MOA/mandate concept could be a viable approach to successfully market EVs on a large scale basis. This implementation technique would make EV production and sales mandatory, but at the same time, wait until EV technology is sufficiently advanced. This would result in high consumer demand and easier mandate compliance by the manufacturers.

Two additional options, which use incentives to address consumer and technological choices, are provided in a Natural Resource Defense Council report on automobile regulation and clean air.[265] The first program, entitled Demand Based Reduction in Vehicle Emissions Plus Increased Fuel Economy (Drive+), is aimed at consumers.[266] This program was actually introduced a few times in the California Legislature.[267] By altering Drive+ to apply specifically to EVs, the consumer would be charged a fee for purchasing an ICV or receive a rebate for purchasing a ZEV. This fee or rebate would be

263. *See supra* notes 220-22 and accompanying text.

264. *See supra* note 112 and accompanying text.

265. *See* Nathanael Greene and Vanessa Ward, *Getting the Sticker Price Right: Incentives for Cleaner, More Efficient Vehicles,* 12.1 PACE ENVTL. L. REV. 91, 94-99 (1994).

266. *See id.* at 94.

267. *See id.*

based on the difference between the price of the ICV purchased and the ZEV, in grams per mile, of each specific emission for which the area where the vehicle will be used is in nonattainment. For each emission that is in nonattainment, the difference, in grams per mile, is multiplied by $1, which represents the cost of these emissions to society.[268] If applied to EVs, the Drive+ program would promote EV sales by making EVs more affordable to purchase and more profitable to sell.

The second program, entitled the Dealer Scrappage Program (Dealer Scrappage), is directed toward automobile dealers and would encourage the retirement of more inefficient and polluting ICVs while promoting the sale of EVs. The automobile dealers would receive a scrappage bounty for every ICV that they accepted as a trade-in towards EV purchase, but only if the ICV was subsequently discarded. The bounty would be based, in part, on the difference in the emission produced by the ICV trade-in and the EV replacement. In other words, the bounty would be proportional to the emission savings that would result. Thus, with this program, consumer incentives to purchase an EV would come from the dealers. This would probably not be too difficult of a task once the dealers are provided with governmental incentives of their own.

Although these alternative EV implementation techniques may not completely solve the EV integration dilemma, they would, at a minimum, offer governments options in addition to MOAs, mandates and *laissez faire* approaches. Perhaps, until EV technology becomes sufficiently advanced so that EVs are comparable in all aspects to ICVs, none of these implementation techniques will be truly successful. However, considering the progress that automobile and battery manufacturers have made and continue to make with EV re-

268. *See id.* Determining societal costs of pollution is possible although admittedly not an easy task. *See id.* at n.11. While incentives would be based on costs to society, the desired effect is achievable with politically determined values. *See id.* California Senate Bill No. 378 proposed initial values for the original Drive+ program introduced in the California legislature. *See id.* This could be a starting point for comparable values under an EV Drive+ program. *See id.*

search and development, the day when EV technology will achieve this level is, in all likelihood, not too far away.

IV. Conclusion

ZEVs are the automobile technology of the future and have the threefold potential to simultaneously accommodate the public in safety and performance, improve air quality, and reduce reliance on nonrenewable energy sources. Inherent in cleaner air are lower health care costs to the government and society, increased participation in outdoor activities, an increase in mental output, and greater life spans due to the reduction in cancer-related deaths, among other things. Moreover, inherent in less reliance on oil and gas is a more stable and reliable economy with a tremendous cut in the national deficit.

MOAs, which integrate EVs based on a market-based demand rate, are the most economically efficient way to introduce EVs into today's society. Mandates requiring automakers to immediately integrate EVs without comparable ICV technology and infrastructure would be premature and could cause EV integration to fail simply due to the timing of their introduction. The *laissez faire* approach could make the possibility of automakers never introducing EVs a reality.

Though EV implementation may not be the sole answer to improving air quality, ZEV production and use would represent a start to less reliance on nonrenewable resources and the existence of cleaner air. Since they are the only ZEVs presently available, EVs are a necessary technology to provide energy, security and a breath of fresh air for the next millennium.