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An Assessment of Potential Energy Savings and Other Benefits from Alternative Fuel Utilization and Employer Trip Reduction Programs

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16. Abstract

By passing the Clean Air Act Amendments of 1990 (CAAA) our government intensified efforts to improve the declining air quality in many of our nation's cities. The passage of the CAAA also signaled the acknowledgment that American commuters must modify travel patterns and behavior. Areas defined as non-attainment by the Environmental Protection Agency must improve their air quality to satisfactory levels or face possible punitive sanctions imposed by the federal government.

In response to the changing demands of urban mobility, city and transportation officials aggressively began pursuing alternative fuels programs in fleet vehicles as a means to improve air quality. In addition to the successful conversions of vehicle fleets to alternative fuels, transportation officials proceeded to influence home-to-work trips thereby improving air quality through the employer trip reduction programs. While air quality improvements are the impetus for increasing alternative fuels technology and trip reduction, there are other unexpected benefits that are beginning to be realized. This research seeks to establish parameters for the measurements of such ancillary benefits beyond alternative fuels and employer trip reduction programs.

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ABSTRACT

By passing the Clean Air Act Amendments of 1990 (CAAA) our government intensified efforts to improve the declining air quality in many of our nation's cities. The passage of the CAAA also signaled the acknowledgment that American commuters must modify travel patterns and behavior. Areas defined as non-attainment by the Environmental Protection Agency must improve their air quality to satisfactory levels or face possible punitive sanctions imposed by the federal government.

In response to the changing demands of urban mobility, city and transportation officials aggressively began pursuing alternative fuels programs in fleet vehicles as a means to improve air quality. In addition to the successful conversions of vehicle fleets to alternative fuels, transportation officials proceeded to influence home-to-work trips thereby improving air quality through the employer trip reduction programs. While air quality improvements are the impetus for increasing alternative fuels technology and trip reduction, there are other unexpected benefits that are beginning to be realized. This research seeks to establish parameters for the measurements of such ancillary benefits beyond alternative fuels and employer trip reduction programs.

EXECUTIVE SUMMARY

For nearly 30 years environmentalists have warned that pollution caused by excessive auto congestion will have negative impacts on this nation's cities. In the last decade our government intensified strategies to address this issue. With the passage of ISTEA, and its sequel, TEA 21, the government has now entered the business of cleaning the air in metropolitan areas where traffic congestion is a daily concern. The impacts of the Clean Air Act Amendments have significantly changed the way states prioritize transportation, and transportation related projects. States with non-attainment regions must now submit statewide plans outlining how they will comply with EPA regulations. This causes the metropolitan planning organizations to submit area-wide plans to achieve these objectives. The public has greatly benefited from the increased involvement and commitment from state officials to clean the air and by being involved in the planning stages of how best to achieve that elusive objective.

The mandates to the clean the air have produced several innovative strategies to reduce pollution by reducing congestion during the peak hours. However, studies have shown that many of these strategies have produced secondary benefits that in most case were unanticipated. The goals of this project were to identify and establish parameters for determining secondary benefits, beyond the principal objective of improving air quality, that might accrue from the alternative fuels and employer trip reduction programs.

This study found that the average consumer may not be able to afford these alternatively fueled vehicles currently, however, automakers anticipate that increased research into new and developing technologies and materials will eventually lower the

cost. The development of the digital watch in the early 1970s sets a precedence of how new technologies impact consumer goods. When initially introduced, the cost of the digital watch may have been as much as $300. Now, one can purchase a digital watch from the corner grocery or drug store for less than $10.

The parameters of determining the ancillary benefits of the ETR and alternative fueled vehicles include identifying the financial characteristics, social benefits, commercial viability, and then ascertaining the transferability of the technology. While not all technologies associated with the ETR and alternatively fueled vehicles will be applicable to the general public, there may be definite benefits in the commercial sector.

Based on the above parameters involving technology transferability, social benefits, and commercial vitality, the ancillary benefits of the Employer Trip Reduction and Clean Air Act Amendments include the following:

Technology Transferability

- Low emission vehicle use for recreational vehicles
- Improved planning tools with broader applicability
- Application of ITS as a planning strategy

Social Benefits

- Convenience services (e.g., cleaners, day care, car care) close to employers or Park & Rides
- Increased employee satisfaction
- Promotion of strategic energy plans
- Enhanced bikeway and pedestrian systems
- Greater emphasis on land use
- Improved interagency liaisons

- Increased attention to regional, as opposed to jurisdictional interests
- Improved coordination through organizations, such as Transportation Management Organizations

Commercial Vitality

- Improved utilization of property and real estate
- Enhanced wireless communications
- Financial benefit to communications companies supporting telework

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Introduction

Public and private transportation providers, as well as others, have aggressively pursued alternative fuels programs in response to legislative requirements to improve the nation's air quality. Simultaneously, clean air act mandates are prompting changes in the home-to-work trips for employees throughout the country. While both of these initiatives have air quality as the motive for implementation, there are other benefits accruing. Recent studies have indicated that these two initiatives are providing certain primary and secondary benefits. From the alternative fuels and trip reduction standpoint, there will be decreases in the utilization of oil. Increased financial savings for those individuals who no longer drive alone will also be realized. These "side effects" merit recognition. This research established parameters for determining social and energy benefits that occur in addition to air quality benefits that accrue from the alternative fuel projects and employer trip reduction programs. Additionally, as part of this study a review of two metropolitan planning organization transportation plans will determine how such organizations adhere to key national mandates regarding air quality and local coordination.

Background

In passing the Clean Air Act Amendments of 1990 (CAAA), the United States government intensified efforts to improve the declining air quality in many cities across the country and the need for American workers to modify their daily commute to and from work. Furthermore, the CAAA set into motion a variety of measures to reduce automobile emissions, including enhanced vehicle inspection programs, the development of cleaner (alternative) fuels, and innovative transportation control measures (TCMs). Initially, employers in a few cities were challenged to reduce the number of single occupant vehicles (SOVs) traveling to their worksite during peak hours. Not every business was affected, only those with 100 or more employees and located in certain "nonattainment zones" designated by the Environmental Protection Agency (EPA).[1] These nonattainment zones had unacceptable levels of carbon monoxide (CO), hydrocarbons (HC) or other volatile organic compounds (VOCs) such as sulfur dioxide (SO^2), oxides of nitrogen (NOx), particulate matter (PM) and compounds of lead (Pb)[2].

Many citizens and officials did not necessarily view the Clean Air Act Amendment favorably. In an article in the February 1993 edition of *Planning* magazine, F.K. Plous quoted Lisa Wormser of the Washington

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[1] Areas rated as nonattainment by the EPA include regions in California, Connecticut, Delaware, Illinois, Indiana, Maryland, New Jersey, New York, Pennsylvania, Texas, and Wisconsin.

[2] Euritt, Mark A., and Lila Paige Warren, "Electric Vehicle Applications for Urban Travelers: Technology, Cost, and the Market", Center for Transportation Research-University of Texas at

D.C. based Surface Transportation Policy Project as she discussed the new transportation legislation: "The way we've been describing it, and I admit it is an oversimplification, is that ISTEA is the carrot and the Clean Air Act can be the stick."[3] One of the "sticks", or punitive provisions, behind the CAAA requirements was the employer trip reduction program (ETR). The requirements of the ETR program, as passed by Congress, were to "...reduce both the numbers of vehicles on the road during rush hours and the time the remaining cars spend idling or operating at inefficient low speeds, thereby reducing emissions of hydrocarbons, carbon monoxide, and nitrogen oxides."[4] Furthermore, Congress enacted Section 182(d)(1)(B) of Title 1 of the Amendments that required each state that contained nonattainment regions to develop and submit state implementation plans (SIPs) defining measures to be implemented to reduce pollutants to acceptable levels as defined by the EPA. Section 182(d)(1)(B) specifically required:

> Each employer of 100 or more persons in the (designated) area to increase average passenger occupancy (APO) per vehicles in commuting trips between home and the work place during peak travel periods by not less than 25% above the average vehicle occupancy (AVO) for all such

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Austin, sponsored by the Southwest Region University Transportation Center, Texas Transportation Institute, Texas A&M University System, March 1996, p 3.

[3] Plous, F.K. Jr., "Refreshing ISTEA", *Planning*, February 1993, p 9.

[4] Reiman, Pamela S., Stephen C. Yohay, "Compliance with Clean Air Act Employer Trip Reduction Requirements", *Employee Relations*, vol. 19, No. 4, Spring 1994, p 621.

trips in the area at the time the SIP revision is submitted.[5]

The APO is calculated by dividing the number of employees arriving at the workplace during the peak period daily by the number of vehicles arriving during the same period.[6] The APO provides an average number of persons arriving to work in each vehicle. The APO is the measure used by the EPA to determine compliance with the requirements as set forth in the CAAA.[7] Before the APO can be derived, each employer must design a survey to be given to its employees to ascertain commuting patterns. A standardized employee survey could be obtained from each state's department of transportation. Failure to adhere to the standards and compliance plans as prescribed by the CAAA subjects employers to a wide range of penalties. At the discretion of individual states, penalties could be severe enough to entice employers to comply or face possible sanctions and/or civil fines and criminal penalties.[8]

While the CAAA designates the ETR program as carrying punitive possibilities for non-compliance, Congress passed the Intermodal Surface Transportation Efficiency Act (ISTEA) as the "carrot" and those municipalities who comply will receive rewards in the form of federal

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[5] Ibid., p 622.
[6] Ibid., p 623. The EPA defines peak travel times to include either the hours between 6:00 a.m. and 10:00 a.m., or any other period that captures 85 percent of the commute trips between 5:00 a.m. and 11:00 a.m.
[7] McNerney, Donald J., "An Overview of the Clean Air Act", *HR Focus*, November 1994, p 3.
[8] Reiman, Pamela S., Stephen C. Yohay, "Compliance with Clean Air Act Employer Trip Reduction Requirements", *Employee Relations*, vol. 19, No. 4, Spring 1994, p 627.

funds for approved projects. Under ISTEA the decision making process is moved to the state level, and in most instances farther down to the various metropolitan planning organizations serving specific regions in each state. The decision making process requires consideration of factors other than the traditional benefit-cost factors to be included in the transportation planning process. In pursuing Clean Air Amendment goals, there is increasing recognition that reducing emissions can have a broad focus. Plous, in a discussion of the ISTEA legislation notes:

> ISTEA acknowledges in law what planners and social critics have been saying for half a century: Transportation decisions affect far more than how people and goods move from point A to point B. They (transportation decisions) have enormous consequences for our air and water, and the way we use land. Transportation influences the where people live, work, and do business.[9]

The original ISTEA bill authorized $151 billion in federal transportation spending over a six year period, fiscal years 1992 to 1997. ISTEA was the first major transportation spending bill since the near completion of the national interstate highway system, which began in 1956. This legislation was the result of the new shift in the mission of the US Department of Transportation (USDOT) requiring transportation planning to be more user friendly, include multimodal capabilities, be

[9] Plous, p 9.

more intermodal, and shift from building new capacity to managing existing capacity.[10]

Metropolitan planning organizations (MPOs) have existed since the early 1960s, following passage of the Federal Highway Act (1962). Their function was to provide a link between state DOTs and the local urban communities. MPOs had little direct influence on how transportation funds were spent or allocated as this power rested with the state DOTs. However, with ISTEA "...MPOs now have authority to allocate federal funds coming into their regions through the Surface Transportation Program and the Congestion-Mitigation and Air Quality Program (CMAQ)."[11] Section 134(f) of the ISTEA legislation listed 15 factors that MPOs must now consider before the transportation planning process can begin. A simplified sample of those factors includes:

- Preserving existing transportation facilities.
- Coordinating transportation planning with federal, state, and local energy conservation programs, goals, and objectives.
- Identifying the effect of transportation policies on land use and their consistency with short and long term development plans.
- Dedicating funds for transportation enhancement projects.

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[10] Walton, C. Michael, and Ned Codd, "Performance Measures and a Framework for Decision Making Under the National Transportation System", Center for Transportation Research-University of Texas at Austin, sponsored by the Southwest Region University Transportation Center, Texas Transportation Institute, Texas A&M University System, March 1996, p 3.

[11] Prendergast, John, "MPOs Become VIPs", *Civil Engineering*, April 1994, p 40

- Consideration of the overall social, environmental and economic effects of proposed transportation projects.
- Exploration of methods applicable to the enhancement of local transit services.[12]

As in all legal and financial matters, ISTEA included provisions for a system of checks and balances. State governors had the authority to veto decisions made by the MPOs, and some governors have even relinquished this authority back to their state's DOT.[13] The effect of this maneuver possibly negates the intended flexibility of ISTEA by placing financing authority back with the state DOTs, and not at the local levels. A review of the transportation plans from the New Orleans and Washington DC areas indicate their attempts to comply with federal requirements.

These two plans were just two of the plans reviewed in a separate study by the Center for Transportation at Texas Southern University to determine compliance with ISTEA regulation from MPOs throughout the nation. From that study it was determined that 67 percent of those plans reviewed addressed all 15 planning factors. Ninety-four (94) percent of the plans included discussions for creating/enhancing *bicycle and pedistrian* facilities, and 83 percent addressed *railroad* and *aviation* transportation systems. What is perhaps the most unexpected aspect of the transportation

[12] A complete list of all 15 ISTEA objectives can be found in Walton and Codd, p 3 and 4.
[13] Prendergast, p 41.

plans reviewed was that only 33 percent discussed multimodal facilities. Many transportation professionals anticipated that multimodal transportation systems would receive more attention from all MPOs due to the influence of ISTEA.[14] While there is no clear explanation for why multimodalism did not garner greater attention, traditional planning practices and inadequate scheduling reduced the attention MPO officials would like to devote to multimodalism. The same traditional planning pressures and short project time frames may also influence the level of attention given to alternative fuel and employee trip reduction programs.

[14] For the purposes of this current study, the assessment of the New Orleans and Washington DC transportation plans will determine the influence of alternative fuels and the Clean Air Act Amendment initiatives.

Case Studies: Two Metropolitan Councils of Government

In order to examine the effect of the Clean Air Act Amendments on area planning organizations and processes, planning activities from two council of governments were assessed: New Orleans and Washington Area Metropolitan Council of Governments. The Transportation Improvement Plans provided the basis for review. Standards and regulations, breadth of participation, and types of trip reduction programs constituted the framework for the perusal.

New Orleans Metropolitan Planning Organization (MPO)

The New Orleans MPO region is made up of five parishes, Jefferson, Orleans, Plaquemines, St. Bernard, and St. Tammany, comprising a total population for this region of 1,181,958 individuals. Their plan addresses preservation and use of existing facilities in many ways, such as the maintenance of an effective and consistent traffic surveillance program on the region's major arterials. The MPO maintains a close watch on traffic patterns and volumes within the region. The plan also developed a Highway Functional Classification System and corresponding map(s), and a method of identifying roadways and roadway segments to be proposed for inclusion in the National Highway System.

The MPO area still retains its designation of "nonattainment transitional". The MPO has the necessary technological capacity through the Mobile 5.0A model to continue tracking regional air quality in

accordance with currently evolving federal and state requirements. Reduction of vehicle miles traveled (VMT) and congestion are two important regional objectives that the MPO is emphasizing in its on-going program. Improvements in these areas will also contribute to the reduction of regional energy consumption.

The New Orleans MPO is developing a Congestion Management Plan for the New Orleans Transportation Management Area. A statewide transportation demand management program has been developed that encourages the use of van pooling and other alternative commuting modes. This program, known as the Louisiana Commuter Network, establishes standards and guidelines for the state and its MPOs to follow when implementing TDM strategies. Grants from the FHWA have helped the region to study the applications of intelligent transportation systems (ITS) technology to the interstate and primary highway systems in the New Orleans Metropolitan Area.

The MPO has worked with the Jefferson Parish Geographic Information System (GIS) Department to accomplish the following: define an airport to downtown air-rail corridor, calculate the land uses within the corridor, and to display and analyze relevant data obtained from multiple sources. More utilization of GIS for these purposes helps planners take into account the effects of transportation policy decisions on land use.

Several projects have been developed for transportation enhancement activities in the New Orleans area. A New Orleans

Metropolitan Area Bikeway Master Plan and a bikeway plan for the City of Mandeville are just two of the many projects the MPO is developing. Landscape buffering and beautification projects are also being developed in the area to help make New Orleans more attractive.

The area's Transportation Improvement Program, per regulation, includes all significant state and locally funded projects. There continues to be regionally significant private land use decisions that have been considered in the transportation planning process. There have not been any significant private sector transportation projects identified.

The MPO has been working with the New Orleans Port Authority, New Orleans Public Belt Railroads, various trucking lines, and other governmental and business organizations to improve access and circulation between port, truck, and rail facilities. This effort has led to projects such as the reconstruction of streets, as well as port access roads in the area. Also, access improvements for the Port of St. Bernard and Alomonaster Bridge were made. There have also been dialogues with the New Orleans Aviation Board for developing strategies that will improve access to the New Orleans Airport.

The planners have redrawn the metropolitan area map to include the urbanized area of eastern St. Charles Parish within its projected twenty-year future growth area boundaries. These changes have made it possible to plan for and improve the connectivity of roadways between the

urbanized areas of the region as well as those lying outside the metropolitan area.

Urbanized areas in the MPOs jurisdiction are primarily responsible for producing their own congestion management systems. The MPO's plan incorporates individual congestion management concepts and also addresses the data requirements and procedures necessary for the development of the intermodal management.

Development of methods to improve the transportation network for intermodal goods movement is a priority in the region. The MPO is working with various public and private organizations to improve access and circulation between port, truck, and rail facilities. The Federal Aviation Administration (FAA) has awarded RPC a grant to undertake the automation of the regional airport system planning process by establishing and maintaining computer databases for eleven Louisiana regional airports. The project will greatly facilitate the development of a more efficient transportation system for the entire region.

The MPO recognizes that perhaps the best way to improve the consideration of social and economic systems, energy usage and conservation is to raise the level of relevant information available to decision-makers. RPC has developed a summary report featuring detailed data delineating social, labor force, commuting habits, income, poverty, and housing characteristics. The plan also has greatly improved its population forecasting techniques with the development of a computer

system which effectively automates the time-consuming burden of manually allocating building permit data to each of the regions 454 traffic zones. Also, information to decision makers included a typical Social Cost Benefit Analysis as an evaluation approach, which uses multi-criteria analysis and life cycle cost techniques.

Planners worked with local parishes, transit operators, the State Department of Transportation and Development (DOTD), the Federal Transit Administration (FTA), Louisiana Public Transportation Association (LPTA), and the Southwest Transit Association (SWTA) to bolster the increasingly crucial role that public transportation must play in providing solutions to our transportation problems. MPO planners also assisted area transit systems in meeting requirements of the Americans with Disabilities Act (ADA) and the Disadvantaged Business Enterprise program (DBE). The plan is a forerunner of project identification and development for inclusion in the region's Transportation Improvement Program.

Metropolitan Washington Council of Governments

The Washington DC region consists of 8 counties: Arlington, Fairfax, Loudoun, Prince William, Fredrick and Stafford Counties in Virginia, and in Maryland the counties of Montgomery and Prince George. The region has a total population of 2,883,865. Local officials recognize the importance of ensuring that the region's transportation planning is

consistent with federal, state and local energy conservation programs, goals and objectives. The plan is consistent with the National Strategy of the U.S. Department of Energy. They recommend the promotion of mass transit, HOV lanes and telecommuting. The plan is consistent with Maryland's and Virginia's strategic energy plans. Both plans recommend the improvement of access and availability of public transportation systems and promote efforts to develop urban bikepaths and walkways.

Transportation policy decisions and the region's land use and development have been considered as two separate activities. The assessment of the feedback effects of transportation condition on expected future land development is a serious and key component of the plan for the first time. The Council of Government staff used the 1993 long-range plan and an updated set of land use forecasts to predict the air quality and congestion impacts. Also, the state and local governments are responsible for ensuring the transportation plan's consistency with local land use and development plans.

The Transportation Improvement Program indicates that processes have been implemented to identify transportation enhancement funds under ISTEA. In the District of Columbia, these include wheelchair and bicycle ramps and facilities, pedestrian bridges, a retaining wall on the historic C&O canal, and renovations on the Taft Bridge. In Virginia, enhancements currently programmed include train restoration, bicycle

accommodations and a pedestrian plaza in the town of Clifton, as well as roadside landscaping and lighting projects.

The Washington metropolitan area has well developed highway connections with numerous roads outside the metropolitan area. There are two projects that have the potential to greatly improve connectivity with the roads to the west and south of the area. The two connections will ease congestion and reduce delay time, thereby improving fuel utilization in a traditional manner.

The state's management systems are currently under development and are expected to provide data on pavement and bridge conditions serving as an information source for future plans. The results of the intermodal management systems will be considered when updating the plan.

The state and local areas both consider right-of-way preservation issues and the potential for development along those corridors. Some of these rights-of-way are being considered for transit development. Others have been identified for potential use as bicycle trails.

The plan expects to provide a slight mitigation in traffic congestion that will provide limited benefits to freight movements. Air improvements and the airport access improvements are also expected to benefit air and freight transportation. In the future, improvements that will help trucking and delivery operations will be suggested through the Congestion Management System. Truck transportation issues are under consideration

as part of several ongoing major studies. A regional air cargo study, currently in the planning stages, may help pinpoint other measures that could enhance the region's freight transportation efficiency.

There are many new investments that will enhance transit services. Planned rail projects include a light rail line, a Metrorail extension, a new Metrorail station and service expansion. Expanding rail or bus services in the transit area will require significant capital and operating funding. These costs must be considered from a trade-off perspective as to whether the air quality or congestion benefits will be worth the capital and operating investment. Further calculations need to be conducted to determine potential fuel savings. Road pricing or widespread parking surcharges will be considered in the vision planning process. These options also would be attractive options for reducing fuel utilization and improving air quality.

Summary of Key National Objective: Employer Trip Reduction Programs

The primary discussion when the CAAA was passed involved whether or not employers were being unduly burdened with modifying the travel behavior of its employees. The commute options available to employers can be divided into three broad categories: 1) how employees travel to work, 2) when employees get to work, and 3) where employees work.[15] Within these broad categories are specific transportation demand management (TDM) strategies which require varying degrees of involvement on the part of the employer. Furthermore, not every TDM measure can be applied in every region of this country, or even with every company in a given city. It is up to each employer to determine which TDM strategy is best for their company and manipulate available resources to make it a successful venture.

The first commute option, *how employees get to work*, entails such TDM strategies as carpools, public transit, walking and bicycling. There are significant challenges in organizing a carpool that employers should acknowledge immediately. The first step is to encourage commuters out of their solo drive without feeling as though a beloved friend has passed away. A company in Illinois volunteered to participate in a vanpool pilot project and immediately encountered difficulties in establishing a plan that was satisfactory to its 900 employees. The vanpool project lasted only four months. Chief among the complaints was deciding on an adequate

departure time for the vanpoolers. The company's director of human resources stated that "People wouldn't wait five minutes for each other...they all went back to driving (their own vehicles)."[16] While the experiences of this carpool program may not be universal, employers do have options for impacting *how* employees arrive to work: guaranteed ride home programs, employer sponsored vanpools, shuttles from public transit facilities to the worksite, and showers and lockers for walkers and bicyclists.

The second commute option, *when employees get to work*, entails switching commuters to nontraditional shifts or compressed work weeks. Rather than the traditional 8 a.m. to 5 p.m. workday employers can shift their employees commute to other schedules such as 7 a.m. to 4 p.m. or 10 a.m. to 6 p.m. In this manner the peak period travel times are dispersed over a greater period for the morning and afternoon commute. Examples of compressed work weeks include four 10 hour days, and nine 9 hour days. Compression of the work week requires enormous amounts of planning on the part of a company's management staff, but the benefits are also enormous. The number of commuting trips are significantly reduced and reports indicate that employee morale tends to increase dramatically because of the frequent three-day weekends.[17]

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[15] Reiman and Yohay, p 630.
[16] Latvian, Laura M., "Clean Air Act's Car-Pool Mandate", *Nation's Business*, April 1994, p 38.
[17] Reiman and Yohay, p 631.

The final commute option, *where employees work*, is the area generating the most interest as a solution to pollution problems. The numbers of employees who work out of their homes either full-time or part-time has seen dramatic increases since the mid 1980's. The New York based Link Resources estimates 39 million people worked from their homes full or part-time in 1993.[18] There is some controversy as to the precise numbers of home workers, though, based on varying definitions of exactly what constitutes home-work, and the fact that many who do work from home do not want that information passed on to the Internal Revenue Service. The predominate TDM strategy applicable to home-based work is that of telecommuting, where the employee would work out of his home a predetermined amount of time per week or month, utilizing computers, modems, fax machines, and copiers. The number of telecommuters rose to 7.9 million in 1993, an increase of 20 percent from 1992 figures.[19]

While telecommuting is a credible TDM strategy, it also provides other benefits to the participating employer. As a direct result of its telecommuting programs, Dunn and Bradstreet of New York projected a 15 to 20 percent savings in real estate costs from 1993 to 1998. Michael Bell, director of real estate for Dunn and Bradstreet stated in *Facilities Design and Management* in October 1993, "The average real estate cost for one employee per year is $4,500. If you include secretarial support and equipment, the cost could go up to $10,000. But in our program of shared

[18] Braus, Patricia, "Homework for Grownups", *American Demographics*, August 1993, p 40.

office space and telecommuting, the costs are cut in half."[20] Similar real estate savings was achieved by AT&T's Business Network Sales Division where the director of sales operations, Robert Wolters, said: "For every $1 we invested in technology, we've saved $2 in real estate."[21]

However, not all telecommuting programs are started out of the desire to save energy, air pollution or real estate costs. Sometimes necessity motivates employers to experiment with different scenarios. The earthquake that hit southern California in January of 1994 increased the numbers of people telecommuting because many of the highways were inoperable.

Encouraging employees in non-attainment areas to give up their personal auto is a tough proposition. This point was verified in a survey given by *Benefits Quarterly* of nearly 600 Certified Employee Benefits Specialists. The survey was developed, in part, to determine the specialists' understanding of the National Energy Policy Act of 1992 and how familiar they were with the development and implementation of employee trip reduction programs. The respondents were asked if they were willing to give up driving their personal vehicles to work to help

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[19] Ibid. p 40.
[20] Bers, Joanna Smith, "Telecommuting May Cut Real Estate Costs, But at What Price?", *Facilities Design and Management*, October 1993, p 44.
[21] Armstrong, Larry, "The Office is a Terrible Place to Work", *Business Week*, December 27, 1993, p 46D.

their employer meet the requirements as stated in the CAAA; 76 percent of the respondents indicated *"No"*.[22]

[22] Carlsen, Melody A., "Transportation Benefits: Breath and Taxes", *Benefits Quarterly*, First Quarter 1994, p 74.

Summary of Key National Objective: Energy Savings

The greatest potential ancillary benefit of air quality improvements is energy savings. The energy savings from reduced dependence on single occupant vehicles for the work trip has the potential to be quite large. However, Americans prefer to drive their automobiles. Lewis and Goodwin (1996) recognized that persuading Houston commuters to relinquish their vehicles is not a popular request. Thus, CTTR developed a flexible model where only a percentage of employees in an activity center or region would be asked to use alternative means to work one to three days per week. Known as the Energy & Air Quality (E*AQ) model, savings of significant amounts of BTU energy could be realized, acknowledging the expenditure of 5,748 BTUs per vehicle mile.[23] Of the total population of 1.6 million in Houston, there is a workforce of 757,521 residents that are 16 years old and older who do not work at home and make the average commute of 14.5 miles to work.[24] If an additional two percent of the above workforce (15,150 workers) utilized some form of commute other than their personal automobile, one day savings of more than 1.2 billion BTUs would be saved. Likewise, 3.1 billion BTUs would be realized if five percent sacrificed their personal automobile for just one day.[25]

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[23] Davis, Stacy C., "Transportation Energy Data Book: Edition 15", Oak Ridge National Laboratory, prepared for the Office of Transportation Technologies-US. Department of Energy, May 1995, Table 2.15, p 2-25.

[24] Demographic data obtained from the 1990 US census.

[25] Employment and workforce figures courtesy of the 1990 US Census for the Houston metropolitan area. The BTU savings were calculated using the workforce employment figures multiplied by the average Houston work trip length and the 5,748 BTUs expended per vehicle mile.

Summary of Key National Objective: Alternative Fuels Utilization

Several states implemented innovative or aggressive programs to mandate or otherwise encourage greater alternative fuel utilization within their state. In particular, the experiences of Texas and California are explored.

Texas

Research into the development of alternative fuels has been hastened by legislation such as the Energy Policy Act of 1992 and the CAAA. The Energy Policy Act requires businesses with fleet vehicles to operate on fuels other than petroleum based fuels, while the CAAA directs individual states to develop and implement alternative fueled fleet programs.[26] The most popular alternative fuels include compressed natural gas (CNG), liquefied natural gas (LNG), liquefied petroleum gas (propane), M-85 (a combination of 15 percent gasoline and 85 percent ethanol, derived from corn, or methanol obtained from natural gas or coal), electricity or battery operated vehicles, and hydrogen. Further, legislation was passed in Texas (Clean Air Legislation of 1989) placing strict alternative fuels requirements on state agencies, school districts and public transit authorities:

[26] Ledé, Naomi W., "A Study of Costs Associated with Alternative Fuels Development: A Case Study", Center for Transportation Training and Research-Texas Southern University, sponsored by

- No such entities will be permitted to purchase or lease vehicles that are incapable of using clean burning alternative fuels after September 1, 1991.
- Thirty percent of all affected fleets will be alternatively fueled by September 1994. This percentage will increase incrementally to ninety percent by 1998 if the Texas Air Control Board (TACB) determines that the program is having a positive effect upon the environment.[27]

California

No other state in the country has initiated more aggressive air quality legislation than California. California's low emissions vehicle program established four categories of vehicles and provided auto manufacturers with incentives to "...earn credits that can be banked, traded or sold, which provides some flexibility if vehicle sales for particular models are poor."[28] These categories are defined as low emissions vehicle, transitional low emissions vehicle, ultra-low emissions vehicles, and zero emissions vehicle. The largest organized alternative fuels program in Southern California involved over 100 Federal Express trucks operating on five different alternative fuels for a period of two years. The results indicated that all the vehicles had lower emissions, but no one alternative

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the Southwest Region University Transportation Center, Texas Transportation Institute, Texas A&M University System, July 1995, p 1.
[27] Ibid., p 4.

fuel out performed the other.[29] California has also mandated that zero emissions vehicles must account for two percent of major automakers' sales in the state of California by 1998. Concerns arise as to the feasibility of this requirement. Automakers insist that "Only battery powered electric vehicles appear to be capable of meeting this standard."[30] Still, automakers are attempting to increase research in designing zero emission vehicles and the manufacturers leading the way are the ones who cannot afford to lose their market share in California: General Motors, Ford, Nissan, Toyota, Chrysler, Mazda, and Honda.

Realizing that a joint effort and sharing of technologies will increase the potential for success, the three US auto manufacturers banded together to develop cost effective battery powered automobiles. The key appears to be cost effectiveness. Chrysler introduced its battery powered minivan in the US in 1996 at a cost of at least $40,000. Ford representative Roberta Nichols stated: "We don't know how to build an electric car in 1998 at a price you and I can afford without the industry losing a great deal of money..."[31]

While the cost of electric vehicles may send consumers into a virtual sticker "shock", polls indicate that 26 percent of Californians would purchase an electric vehicle, if a reasonably priced, operationally solid

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[28] Euritt, p 8.
[29] Olesen, Douglas, "Technology Strategies for 2005", *Executive Speeches*, October/November 1995, p 30.
[30] Candler, Julie, "The Mandate for Alternative Fuels", *Nation's Business*, June 1994, p 49 and 50.
[31] Ibid., p 52.

option were available. Additionally, the convenience and availability of electricity make establishing recharge facilities less daunting a task as natural gas service areas, which may cost "...hundreds of millions or even billions of dollars...to conveniently accommodate refueling needs."[32] Electric recharge facilities could easily access existing power lines beneath city streets, providing unlimited locational opportunities and convenience for the consumer. Furthermore, officials anticipate the time necessary to fully recharge a battery to be approximately 15 minutes, but as technology increases, a recharge time of 6 minutes is not unrealistic.[33] Research is underway at Bell Communications Research to develop a new lithium ion battery, whose size will resemble that of the standard credit card, possessing twice the power per unit of weight as nickel cadmium batteries.[34]

Many companies are converting their vehicle fleets to fuels other than gasoline or diesel. As of 1997, these vehicles cost in excess of $30,000 each with limited range and acceleration power. The top speed of Ford's 1998 Electric Ranger is 75 mph, with the ability to operate between 35 and 58 miles before necessary recharging.[35] While the physical appearance of Ford's Electric Ranger is the same as the gasoline powered

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[32] Tucker, Michael, "The Shocking State of Electric Car Technology", *Business and Society Review*, p 46-47.
[33] Ibid. p 46.
[34] Baker, Nancy Craft, "Alternative Fuel Industry Gears Up for Greater Use", *Environment Today*, January/February 1995, p 11.
[35] The variation in vehicle range is dependent upon temperature and the use of the air conditioning or heating units.

version, it is almost twice as expensive. While businesses may be mandated to convert their vehicle fleets, the average consumer has no such inducement to spend twice as much for a vehicle to get less performance.

Defining Parameters

New technologies are being investigated to further the development and applications in the area of alternative fuels. In other sciences, particularly in the medical sciences, ancillary benefits have been witnessed from medicines that were completely unexpected. For example, medical officials determined the drug Rogaine could be used to re-grow hair in some pattern baldness cases. Rogaine was originally a component in the medicine used to treat high blood pressure. Similarly, certain weight loss supplements have been recognized as alleviating nasal congestion and sinus problems. Unexpected benefits are being realized from the implementation of the Clean Air Act Amendment requirements. The following paragraphs establish parameters to determine whether "ancillary benefits" is an appropriate identification in this instance.

Technology Transferability

A critical first question is whether the technology or concept is transferable? The technology required to produce a zero-emissions vehicle should be made available to researchers in other disciplines to assess its applicability in divergent fields. Many golf enthusiasts already enjoy the battery-operated ride of their golf carts, and zero-emissions technology may enhance this existing application. By transferring what is already known and understood about battery-operated golf carts, manufactures may be able to produce a hybrid commuter vehicle capable of reaching and

maintaining highway speeds for limited distances. Zero-emissions technology may also be applicable in traditionally small combustion engine applications such as lawnmowers, snowmobiles, as well as 4-wheeled all-terrain vehicles.

Another technology transfer benefit is that tools developed for various purposes have been evaluated and utilized in support of planning efforts. For instance, GIS tools have been used to study various land use scenarios in determining which option may result in a land use pattern more conducive to positive air quality. Also, Intelligent Transportation Systems (ITS) capabilities allow travelers to make choices which lower miles driven and fuel utilized. One primary rationale for ITS deployment is to more efficiently utilize existing roadways, thereby increasing throughput without expanding the physical structure. The supplementary benefit of improved fuel efficiency and air quality contributes to greater sustainability.

Social Benefits

The second parameter concerns social benefits. The definition of what constitutes a *social benefit* will vary from individual to individual. However, it should be acceptable to say that social benefits are those that generally advance causes for society as a whole, regardless of race, income, or social standing. Acknowledging that ETR programs only impact certain businesses, their ancillary benefits may not be seen by the

entire business community or society. However, as part of the effort to encourage commuters to try alternate means of transportation, many office complexes have encouraged other entrepreneurs who own or operate businesses like daycares, cafeterias, and dry cleaners to relocate within walking distance. One social benefit of this strategy can be found in the creation of new jobs. While only a segment of the workforce uses childcare facilities, many employers have found that working mothers and fathers require less time away from the workplace when these facilities are located close to work. Additionally, when businesses participate in some form of childcare subsidy reimbursement for their employees, many respond with increased loyalty and production. This may be due to employees' perception that their employer not only cares about what work they produce, but is also concerned about their personal responsibilities and concerns.

Another social benefit is the development of strategic energy plans increases public awareness to the crucial nature of environmental degredation. While many private entities acknowledge the importance of environmental awareness, most have been unwilling to actually encorporate action plans for compliance within their purview. The increased visibility and acceptance of the ETR strategies will provide encouragement to those who question the full benefit of such programs. With such tangible social benefits, many skeptics will be forced to the realization that being a part of a community means more than providing

and service or product. It means ensuring the quality of life remains unchanged so future generations will not have to suffer the effects of decisions made based on economics.

Many communities have initiated feasibility assessment studies involving dedicated right-of-way for bicycle and pedestrian access. One of the barriers to these alternatives has been the danger involved in mixing nonmotorized modes with the auto. Federal legislation provides money for those communities willing to actively promote and support bicyclists and pedestrians. Hike and bike trails are commonly mentioned when one considers nonmotorized facilities. However, these are primarily designed for recreational purposes. Dedicated bike lanes, and wider sidewalks are ways in which nonmotorized modes could be encouraged without a great financial investment or hardship to the community. To the private company, this strategy requires little planning or altering of existing policies and procedures. As long there are facilities to store the bicycle during the day and possibly to shower, when needed, the company makes positive contribution towards improving air quality and simultaneously builds good will in the community.

By continuing to increase awareness to the importance of air quality, two related ancillary benefits also provide social benefits. As agencies begin to establish a dialog amongst themselves as to the best methods available to improve air quality, what happens is improved interagency

communications. The common goal of air quality becomes a greater concern than worrying about one's position in the market place.

The other similarly related social benefit is the increased attention to air quality as a regional rather than a local issue. Officials in Houston felt confident in asserting the city of Victoria's lack of EPA conformity was due to the that city being "downwind" from Houston (Victoria is a community about 60 miles southwest of Houston along state highway 59). This is a positive example of how noncomformity affects more than just the local residents and community. In the Houston example, area officials must be willing to communicate and view air quality challenges regionally. Just as the region benefits from the strength of Houston's economy, so too must the region prepare to address the challenges that come with an economy based on energy production.

In addition to increased communications between private companies, there will also be the increased coordination between regional transportation management associations (TMAs). These TMAs provide transportation related information and strategies to those entities within their jurisdiction. In some jurisdictions the TMA's goal may involve congestion relief. However, it has been proven that a reduction in congestion typically equates to a reduction in air pollutants. As regionally attention begins to focus on these pollutants, TMAs will be encouraged to coordinate resources and information as a part of a larger regional strategy.

Simultaneous to implementation of the Clean Air Act Amendments has been interest in development of sustainable or livable communities concepts. The latest version of this set of principals is termed, "Smart Growth" and focuses on decision making which allows the resident a set of choices in trip-making. The choices center on the ability to walk, bicycle, or take transit to work. While moving independent of the CAAA requirements, the momentum for more focused and well-thought development will result in communities that have lower single-occupant miles driven. Some will argue that these more "livable communities" will offer their residents a higher overall quality of life.

Commercial Vitality

Another parameter concerns commercial vitality. To realize ancillary benefits from alternative fuels and ETR programs, the commercial sector must believe that the technology will in some way enhance business operations and increase profits. Telecommuting has proven to be a successful Travel Demand Management strategy, while simultaneously reducing real estate and office requirements.

The communications necessary to accommodate telecommuters has given additional support to the wireless communications industry. Equipment such as high-speed modems has become indispensable for those who work at home or at satellite locations. As a consequence, communications companies have committed significant research dollars to

the on-going development of equipment like modems to increase the reliability and speed of communications transfer.

Summary

Based on the above parameters, the ancillary benefits of the Employer Trip Reduction and Clean Air Act Amendments are as follows:

Technology Transferability

- Low emission vehicle use for recreational vehicles
- Improved planning tools with broader applicability
- Application of ITS as a planning strategy

Social Benefits

- Convenience services (e.g., cleaners, day care, car care) close to employers or Park & Rides
- Increased employee satisfaction
- Promotion of strategic energy plans
- Enhanced bikeway and pedestrian systems
- Greater Emphasis on Land Use
- Improved interagency liaisons
- Increased attention to regional, as opposed to jurisdictional interests

- Improved coordination through organizations, such as Transportation Management Organizations

Commercial Vitality

- Improved utilization of property and real estate
- Enhanced wireless communications
- Financial benefit to communications companies supporting telework

Conclusions

The Clean Air Act Amendments have had a significant influence in state-wide planning since their inception. States with non-attainment regions are required to submit statewide plans outlining how they will comply with EPA regulations. The public has benefited by witnessing the commitment of the state officials to the clean air objectives and by being involved in the planning stages of how best to achieve that elusive objective.

Research into the applicability of alternative fuels continues as researchers seek to find ways to make these vehicles more affordable to the general public while simultaneously increasing power and range. Still, the commitment of school districts and government agencies to convert existing fleets to fuels other than gasoline or diesel is another indicator that the recognition of the harmful effects of pollution is not being ignored.

While the average consumer may not be able to afford these vehicles, it is anticipated that new research technology and materials will lower the cost. A precedence for this example can be found with the development of the digital watch in the early 1970s. When initially introduced, the digital watch may cost as much as $300. Now, a digital watch can be purchased at the corner grocery or drug store for less than $10.

Another example of the lowering costs of technology can be found with personal computers. Over the last decade the computer industry has seen the introduction of laptop computers that are less than half the size and weight of desktop models. Even with the decreased size, the capabilities of these laptops, in many instances, exceeds the performance of their larger counterparts without significant increases in costs. Generally, computers are able to do more while continuing research has held the cost fairly stable.

Soon after George W. Bush assumed the office of governor of Texas, the emphasis on ETR programs switched from mandatory to voluntary. The screams heard from the business community were those of cost and uneven enforcement of regulations. Governor Bush acknowledged the business community and set in motion alternative plans for meeting EPA regulations without placing what he considered undue financial burdens on the business communities of Texas. Therefore, initial implementation costs seem to be the first objection cited by companies when asked why they were not complying with the EPA requirements.

The parameters of determining the ancillary benefits of the ETR and alternative fueled vehicles include identifying social benefits, commercial viability, and then ascertaining the transferability of the technology. While not all technologies associated with the ETR and alternatively fueled vehicles will be applicable to the general public, there may be definitive benefits in the commercial sector.

Although reduced to voluntary status, the ETR program has generated enough support that strategies to reduce congestion and pollution have found widespread support in our communities and local governments. Finally, as research continues into alternatively fueled vehicles, it is anticipated that interest among the general public will increase as, hopefully, the expenses will decrease. It is important to note that increased advantages because of ancillary benefits will occur as alternative fuels projects continue to gain strength due to continued public and political support.

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