

Cleaner Alternative Fuels for Fleets: An Overview

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The Clean Air Act Amendments of 1990 (CAAA) and the Energy Policy Act of 1992 (EPact) require conversion to alternative fuels of vehicle fleets in cities with populations greater than 250,000. CAAA and EPact have similar provisions but different requirements. CAAA does not require a specific fuel type but mandates that specific emission levels be met to comply with the regulation's provisions and possibly earn extra emission reduction credits as clean fuel fleet vehicles (CFFV). Key aspects that will facilitate compliance are tax deductions under EPact and marketable emissions reduction credits under CAAA. Fleets were emphasized by Congress because they have a better refueling and maintenance infrastructure, more frequent vehicle turnover, and greater yearly mileage accumulation. CAAA applies to nonattainment areas classified as serious, severe, and extreme. Private and government fleets of 10 or more vehicles capable of being centrally fueled are affected by the program. The program is based on fleet owners purchasing a prescribed percentage of new fleet purchases as CFFVs, which meet lower emission standards. Under CAAA the phase-in period is a purchase rate of 30 percent in 1998, 50 percent in 1999, and 70 percent in 2000 and thereafter for light-duty vehicles. Heavy-duty vehicles remain at the 50 percent level beginning in 1998. The Environmental Protection Agency (EPA) estimates that more than 40,000 private and government fleets will be affected by the CAAA fleets program. EPact, which is administered and enforced by the Department of Energy (DOE), applies to all cities with a population of 250,000 or greater, regardless of air quality nonattainment status. This doubles the number of fleets covered. State fleets are required to be phased in to the program with 10 percent of their purchases in 1996 and 15 percent in 1997. The difference here is that affected fleets must have more than 20 vehicles. At its discretion, DOE may apply EPact to private fleets. Congress directed EPA to exempt qualifying fleet CFFVs, which are called inherently low-emission vehicles, from certain transportation control measures that are time-of-day or week based, such as the ability to use high occupancy vehicle lanes. A state that has a banking and trading program and a low-emission vehicle program would more easily administer and enforce a clean fuel fleet vehicle program.

More than one-third of the United States population breathes air contaminated with pollutants such as carbon monoxide, ground level ozone (known commonly as smog), and potent air toxic carcinogens. One of the primary goals of the National Ambient Air Quality Standards is to reduce ozone-forming pollutants, such as volatile organic compounds (VOC) and oxides of nitrogen (NO_x). Research increasingly implicates vehicle emissions as contributing more significantly to air toxics in urban air than had been previously believed.

Cars, buses, and trucks are responsible for one-third of ozone precursors and two-thirds of carbon monoxide emissions in air quality nonattainment areas. It is not surprising that the Congress and the President have assigned a significant role to the transportation sec-

tor to alleviate air quality nonattainment problems in the United States.

The Clean Air Act Amendments of 1990 (101st U.S. Congress), (CAAA) and the Energy Policy Act of 1992 (103rd U.S. Congress) (EPact) each require new purchases and conversions of vehicle fleets to use alternate fuels. EPact applies to all cities with populations greater than 250,000. CAAA applies to air quality nonattainment areas classified as serious, severe, and extreme and carbon monoxide nonattainment areas classified as moderate and serious and have concentrations monitored greater than 12.7 parts per million. CAAA and EPact have similar provisions but different requirements. CAAA does not require a specific fuel type but mandates specific emission levels for vehicle fleets to qualify as clean fuel vehicles (CFVs) and earn tradable credits. Key aspects that will facilitate compliance are tax deductions under EPact and marketable mobile emissions reduction credits (MERCs) under CAAA.

CAAA and EPact require affected states to begin purchasing cleaner, alternative-fuel vehicles for centrally fueled fleets. As one of the largest sources of carbon monoxide and ozone-forming pollutants, mobile sources were targeted for emission reduction programs under Title II of CAAA. Part C of Title II establishes definitions, requirements, and standards for CFVs. These provisions require affected states to modify their state implementation plans (SIPs) by May 15, 1994, to require that certain portions of the new vehicles purchased by fleet owners meet clean-fuel fleet vehicle exhaust emission standards. These standards are similar to the Low Emission Vehicle Rating (LEVR) program (Table 1). In September 1990, the California Air Resources Board (CARB) approved a low-emission vehicle and clean fuels set of regulations. The regulations established four new classes of emission levels, similar to those in CAAA and the clean fuel fleets emission levels found in Table 1. Note that the Clean-Fuel Fleet Vehicle (CFFV) program does not have a transitional low emission vehicle (TLEV) category as does the CARB program. A controversial aspect of the Low-Emission Vehicle (LEV) program in California and other states has been the zero-emission vehicle (ZEV) sales mandate (2 percent of all sales in 1998, 5 percent in 2001, and 10 percent in 2003). Automobile manufacturers are working with EPA and the Ozone Transport Commission to establish a "49 State Car" which has emission levels similar to Tier II vehicles but with an earlier implementation date and the provision that the ZEV mandate be dropped. Unfortunately, EPA cannot abrogate state legislative decisions in states that have chosen to pursue the ZEV mandate.

Massachusetts and New York have adopted LEV programs. Texas, Illinois, Wisconsin Maryland, Pennsylvania, and Maine have considered adopting the LEV program. In October 1991, the Ozone Transport Commission (OTC) states signed a memorandum of understanding on the California LEV program. In signing this,

TABLE 1 Emission Standards for Determining MERC Weightings

Light-Duty Vehicle and Truck Emission Levels for Credit Calculation (gm/mi)					
	LDV, LDT ≤6000 GVWR, ≤3750 LVW	LDT ≤6000 GVWR >3750 LVW ≤5750 LVW	LDT >6000 GVWR, ≤3750 TW	LDT >6000 GVWR, >3750 TW ≥5750 TW	LDT >6000 GVWR, >5750 TW
<u>Tier 1 Gas</u>					
NMHC ¹	0.25	0.32	0.25	0.32	0.39
CO	3.4	4.4	3.4	4.4	5.0
NOx	0.4	0.7	0.4	0.7	1.1
<u>LEV</u>					
NMOG	0.075	0.1	0.125	0.16	0.196
CO	3.4	4.4	3.4	4.4	5.0
NOx	0.2	0.4	0.4	0.7	1.1
<u>ULEV</u>					
NMOG	0.04	0.05	0.075	0.1	0.117
CO	1.7	2.2	1.7	2.2	2.5
NOx	0.2	0.4	0.2	0.4	0.6
<u>ZEV</u>					
NMOG	0.0	0.0	0.0	0.0	0.0
CO	0.0	0.0	0.0	0.0	0.0
NOx	0.0	0.0	0.0	0.0	0.0
Heavy Duty Vehicle 8,501-26,000 GVWR					
<u>Conventional Vehicle</u>					
	HC+NOx ²			5.3	
	CO			15.5	
<u>LEV</u>					
	NMHC+NOx			3.8 ³	
	CO			15.5	
<u>ULEV</u>					
	NMHC+NOx			2.5	
	CO			7.2	
<u>ZEV</u>					
	NMHC+NOx			0.0	
	CO			0.0	

Source: EPA

¹ For MERCs, NMHC = NMOG

² For MERCs, HC = NMHC. Also, the conventional HDE standard is not combined

³ At the time of publication the author could not verify with EPA final HDV LEVR ratings

each member state agreed to propose regulations or legislation necessary to adopt the LEV program in accordance with Section 177 of CAAA. On February 1, 1994, the OTC voted to recommend that EPA mandate the California LEV program in the Ozone Transport Region and shortly thereafter petitioned EPA to do so. EPA was expected to issue a final rule on the LEV program for light-duty vehicles in the Ozone Transport Region in late 1994. However, individual state enabling legislation and regulations may be required for the LEV program. The Environmental Protection Agency (EPA) issued a final rule in January 1993 (58 CFR 11888) that established regulations governing the clean-fuel fleet credit program and the exemption of CFVs from certain transportation control measures (TCMs). EPA issued a notice of proposed rulemaking providing further clarification of clean-fuel fleet emissions standards, conversions, and general provisions (59 FR 32474, June 10, 1993). EPA also finalized the definition of terms used with the Clean-Fuel Fleet program (58 FR 60038, December 17, 1993).

The number of covered fleet vehicles in the nonattainment area will be based on two separate 1-week (7-day) vehicle mileage sampling surveys conducted in 1995 or 1996. This average fleet ratio is determined via the following equation:

$$\frac{\text{miles traveled in nonattainment area}}{\text{total miles driven}} = \text{no. of covered fleet vehicles}$$

This average fleet ratio is used to calculate the number of vehicles that are not centrally refueled 100 percent of the time, not garaged at a personal residence at night, and are capable of being centrally refueled. The operating range of the CFV is the distance a vehicle is able to travel on a round trip with a single refueling.

EPA finalized Emission Standards for Clean-Fuel Vehicles and Engines, Requirements for Clean-Fuel Vehicle Conversion, and the California Test Program (40 CFR Parts 86 and 88) on September 30, 1994. This rule makes conversion kits certify to LEVR standards and allows the converted vehicle to pass the inspection and maintenance (I/M) test. This kit certification and vehicle testing procedure will make post-September 1994 vehicle conversions more economically competitive with original equipment manufacturer (OEM) CFV vehicles. Also, the heavy-duty vehicle NO_x low-emission vehicle standard was relaxed from 3.5 per brake horsepower/hour (g-bhp/hr) to 3.8 g-bhp/hr because of industry concerns about the viability of alternative fuels for heavy-duty vehicles. Further regulations are expected from the Department of Energy (DOE) for EPact, under the alternative fuel fleet program clarifying DOE's intent.

CAAA AND EPACT ISSUES

The key differences between CAAA and EPact requirements as they apply to states are the fuels allowed, the vehicle classes affected, the geographic areas with covered fleets, and the timing of implementation. For example, clean fuels under CAAA include two fuels that EPact does not consider to be alternative fuels: reformulated gasoline and low sulfur diesel fuel. EPact defines alternative fuels as compressed and liquefied natural gas, liquefied petroleum gas, methanol and ethanol (mixtures of 85 percent or more, i.e., M-85, E-85, or "neat" 100 percent fuel), electricity, hydrogen, coal-derived liquids, and fuels derived from biological materials.

In addition to light-duty vehicles (LDVs) and light-duty trucks (LDTs) affected under EPact [vehicles with a gross vehicle weight rating (GVWR) of less than 8,500 lb], the CAAA fleet program

includes heavy-duty vehicles with a GVWR between 8,501 and 26,000 lb as a separate affected class. For diesel vehicles, the new diesel NO_x standard beginning in 1998 is 4 g-bhp/hr. The recent low-sulfur diesel fuel regulation in effect combined with the new diesel engine emission standards in 1998 may make diesel engines to LEVR standards. EPA issued a report to Congress in October 1993 on promising diesel engine and fuel improvements to reduce NO_x and particulate matter. A CNG bus has been certified to 2 g-bhp/hr, and many metropolitan planning organizations (MPOs) and departments of transportation (DOTs) are buying these buses for NO_x offsets to pass conformity tests.

APPLICABILITY AND COVERED FLEETS

Congress emphasized fleets because they have a better refueling and maintenance infrastructure, more frequent vehicle turnover, and greater annual mileage accumulation than individually owned vehicles.

CAAA encompasses 22 cities in 19 states (Table 2). The new program affects private and government fleets of 10 or more vehicles that can be centrally fueled. The program requires fleet owners to purchase a prescribed percentage of new fleet vehicle purchases as CFVs, which meet lower emission standards. Certain vehicles are exempt from regulation, such as law enforcement and emergency vehicles and vehicles held for test, rental, or sale. EPA has clarified that vehicles garaged at home are not exempt from the clean fuel fleet provisions if they can be centrally fueled 75 percent of the time. Businesses (usually small) that rely on their employees to use their own vehicles for delivery or sales work would be exempt from the CFFV regulations because those vehicles are garaged primarily at home, and the employer does not provide nonpublic central refueling facilities.

EPact, which is administered and enforced by DOE, applies to all cities with a population of 250,000 or greater, regardless of air quality nonattainment status. EPact doubles the number of fleets covered (Table 3). EPact-affected fleets must have more than 20 vehicles. At its discretion, DOE can apply EPact to private fleets, but if has not yet ruled on this. Small fleet owners with fewer than 20 vehicles but more than 10 can comply with CAAA by using Federal Reformulated Gasoline (RFG), available in many areas in 1995, if the purchased vehicle engine class certifies to LEVR standard. An RFG LEVR vehicle may be possible by electrically preheating the catalyst to eliminate cold-start emissions the first 505 sec after ignition, before the catalyst is heated for efficient pollution abatement.

FUEL TYPES

Although CAAA is an emissions-based program requiring the use of cleaner, alternative fuels, DOE designed EPact to further national energy use goals. Hence, CAAA emphasizes "clean" fuels and EPact refers to "alternative" fuels that would diminish national dependence on petroleum-based vehicle fuels. EPact should affect states before CAAA. However, DOE will not release most EPact regulations until late 1994. DOE has indicated that it generally will consider EPA's lead in development of CAAA CFFV requirements, but it is not certain that DOE regulations will complement those EPA requirements.

TABLE 2 States and Areas Covered by CAAA Clean Fuel Fleet Vehicle Program

1.	Atlanta	Georgia
2.	Baltimore	Maryland
3.	Baton Rouge	Louisiana
4.	Beaumont-Port Arthur	Texas
5.	Boston-Lawrence-Worcester (Eastern Massachusetts)	Massachusetts, New Hampshire
6.	Chicago-Gary-Lake County	Illinois Indiana
7.	Denver-Boulder	Colorado
8.	El Paso	Texas
9.	Greater Connecticut	Connecticut
10.	Houston-Galveston-Brazoria	Texas
11.	Los Angeles-South Coast Air Basin	California
12.	Milwaukee-Racine	Wisconsin
13.	New York-Northern New Jersey-Long Island	Connecticut, New Jersey, New York
14.	Philadelphia-Wilmington-Trenton	Delaware, Maryland, New Jersey, Pennsylvania
15.	Providence (All Rhode Island)	Rhode Island
16.	Sacramento Metro	California
17.	San Diego	California
18.	San Joaquin Valley	California
19.	Southeast Desert Modified AQMA	California
20.	Springfield (Western Massachusetts)	Massachusetts
21.	Ventura County	California
22.	Washington (District of Columbia)	Maryland, District of Columbia, Virginia

Source: EPA

NEW PURCHASE PHASE-IN PERIODS

The phase-in period under CAAA is a purchase rate for new and replacement light-duty vehicles of

- 30 percent beginning in model year (MY) 1998,
- 50 percent in MY 1999,
- 70 percent in MY 2000 and thereafter, and

- Heavy-duty vehicles remain at the 50-percent level beginning in MY 1998.

EPA estimates that the CAAA fleets program will affect over 40,000 private and government fleets.

Under EPact, state government fleets are required to phase in the new vehicle purchase requirements on the following schedule:

- 10 percent of new vehicle purchases in 1996,
- 15 percent of new vehicle purchases in 1997,
- 25 percent of new vehicle purchases in 1998,
- 50 percent of new vehicle purchases in 1999, and
- 75 percent of new vehicle purchases in 2000 and thereafter (Table 4).

Note that in 1998, 5 percent of new state government fleet purchases may be able to operate on RFG, depending on engine class certification results to LEVR standards with RFG as the fuel, and comply with CAAA. In 1999, both new vehicle purchase levels for state government fleets are 50 percent for light-duty vehicles. After 2000, the light-duty vehicle new purchase requirements remain at 75 percent under EPact and at 70 percent under CAAA.

COMPLIANCE ISSUES

The program requirements can be met through new vehicle purchases, vehicle conversions, or credits. The program is administered and enforced by affected state governments. To comply with CAAA, the vehicles must, at a minimum, meet the LEVR standard. The alternative/clean fuel gallon use per month at dispensing facilities will be used by states to determine compliance for both dual- and dedicated-fueled vehicles based on reported average monthly mileage accumulation for the specific fleet.

To demonstrate compliance, EPact defines alternative fuel vehicles (AFV) as either a dedicated or dual-fuel vehicle using an EPact-designated alternative fuel. However, CAAA requires the purchase of CFVs (dedicated or dual fueled) based on their classification of LEVR standards (Table 1). CAAA establishes three classes of low-emission vehicle ratings for fleet purposes:

- LEVs—nonmethane organic compounds (NMOG) at 0.075 g/mi for LDVs,
- Ultra-low-emission vehicles (ULEVs)—NMOG at 0.04 g/mi for LDVs, and
- ZEVs—NMOG at 0.0 g/mi for LDVs (on-road emissions).

(Note that Table 1 is slightly outdated and is derived from CAAA. The light-duty vehicle and truck emission levels have not changed for the LEVR program. However, at the time of this writing, revised data on heavy-duty engine emission levels could not be clarified. Check with the EPA regional office for clarification.)

It is expected that OEMs of alternative-fuel vehicles will certify vehicles according to the EPA-designated LEVR standards.

MOBILE EMISSIONS REDUCTION CREDITS

Purchase credits are available for early/extra CFV purchases (pre-1998) of ULEVs and ZEVs and noncovered category purchases. Credits may be traded for use within the same or contiguous non-

attainment area. The purchase credits for this program may be banked with no time limit or depreciation. The only caveat is that MERCs cannot be traded upward between light-duty and heavy-duty vehicles. Small companies may be able to buy credits from larger companies.

CFFV MERCs may be allowed to be traded to other emission sources in the same urban air shed. This could be a big benefit to large utilities with sizable stationary sources and large fleets of vehicles. This is a direct incentive to fleet owners to increase use of clean fuels and purchase dedicated fuel vehicles. Motor vehicle control, especially of fleets, is still an optimal way to effectively control air emissions. The CFFV MERC incentive also provides an added stimulus to develop a CFV/AFV refueling infrastructure that may be available to the general public. Any increased access to alternative refueling facilities could increase demand for clean fuel vehicles. It is important to note that states would administer and enforce this program. Moreover, vehicles may receive credits or TCM exemptions, but not both, for the same emission reduction.

TCM EXEMPTIONS

Congress directed EPA to exempt qualifying fleet CFVs from certain TCMs that are based on use by time of day or week. For example, inherently low emitting vehicles (ILEVs), which have zero

evaporative emissions, enjoy the use of HOV lanes even if the vehicle has only one occupant. Clean fuel vehicles most likely will be identified with a large green global decal that reads "ECO." Other possible exemptions for ILEVs are from the Employee Commute Option/Employer Trip Reduction (ECO/ETR) program or congestion pricing. The program is designed to be fuel neutral. In the federal ILEV program, the vehicle must

- Qualify as a CFV,
- Meet the ULEV NO_x standard (0.2 g/mi for LDVs),
- Have no evaporative emissions (even without a control system), and
- Be a dedicated fuel vehicle (run only on clean fuel).

EPA expects significant environmental benefits from the ILEV portion of the program. Vapor emissions are expected to be reduced by about 0.35 g/mi. This reduction is more than twice that achieved by meeting the CFFV exhaust emission standard for the same pollutant. It is hoped that ILEVs provide enough incentive to stimulate the nonfleet demand to broaden the CFV market for automakers. A state that has a banking and trading program and a LEVR program would more easily administer and enforce a CFFV program. This is because familiarity with LEVR-certified vehicles and quantification of MERCs may be more familiar to key state government staff. Also

TABLE 3 Metropolitan Statistical Areas and Consolidated MSAs with 1980 Population of 250,000 or More

Albany-Schenectady-Troy NY	Canton-Massillon OH	Davenport-Moline-Rock Island IA-IL
Albuquerque NM	Charleston SC	Dayton-Springfield OH
Allentown-Bethlehem-Easton PA	Charleston WV	Daytona Beach FL
Appleton-Oshkosh-Neenah WI	Charlotte-Gastonia-Rock Hill NC-SC	Denver-Boulder-Greeley CO
Atlanta GA	Chattanooga TN-GA	Des Moines IA
Augusta-Aiken GA-SC	Chicago-Gary-Kenosha IL-IN-WI	Detroit-Ann Arbor-Flint MI
Austin-San Marcos TX	Cincinnati-Hamilton OH-KY-IN	El Paso TX
Bakersfield CA	Cleveland-Akron OH	Erie PA
Baton Rouge LA	Colorado Springs CO	Eugene-Springfield OR
Beaumont-Port Arthur TX	Columbia SC	Evansville-Henderson IN-KY
Binghamton NY	Colombus OH	Fort Wayne IN
Birmingham AL	Colombus SC-GA-AL	Fresno CA
Boise City ID	Corpus Christi TX	Grand Rapids-Muskegon-Holland MI
Boston-Worcester-Lawrence MA -NH-ME-CT	Dallas-Fort Worth TX	Greensboro-Winston Salem-High Point
Buffalo-Niagara Falls NY		Greenville-Spartanburg-Anderson SC
Harrisburg-Lebanon-Carlisle PA	Lexington KY	New London-Norwich CT-RI
Hartford CT	Little Rock-N. Little Rock AR	New Orleans LA
Honolulu HI	Los Angeles-Riverside-Orange County CA	New York-N. New Jersey-Long Island NY-NJ-CT-PA

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TABLE 3 (continued)

Houston-Galveston-Brazoria TX	Louisville KY-IN	Norfolk-Virginia Beach-Newport News VA-NC
Huntington-Ashland WV-KY-OH	Macon GA	Oklahoma City OK
Indianapolis IN	Madison WI	Omaha NE-IA
Jackson MS	McAllen-Titusville-Palm Bay FL	Orlando FL
Jacksonville FL	Memphis TN-AR-MS	Pennsacola FL
Johnson City-Kingsport-Bristol TN-VA	Miami-Fort Lauderdale FL	Peoria-Pekin IL
Kansas City MO-KS	Milwaukee-Racine WI	Philadelphia-Wilmington-Atlantic City PA-NJ-DE-MD
Knoxville TN	Minneapolis-St. Paul MN-WI	Phoenix-Mesa AZ
Lakeland-Winterhaven FL	Mobile AL	Pittsburgh PA
Lancaster PA	Modesto CA	Portland-Salem OR-WA
Lansing-East Lansing MI	Montgomery AL	Providence-Fall River-Warwick RI-MA
Las Vegas NV-AZ	Nashville TN	Raleigh-Durham-Chapel Hill NC
Reading PA	Seattle-Tacoma-Bremerton WA	Youngstown-Warren OH
Richmond-Petersburg VA	Shreveport-Bossier City LA	
Rochester NY	Spokane WA	
Rockford IL	Springfield MA	
Sacramento-Yolo CA	Stockton-Lodi CA	
Saginaw-Bay City Midland MI	Syracuse NY	
St. Louis MO-IL	Tampa-St. Petersburg-Clearwater FL	
Salinas CA	Toledo OH	
Salt Lake City-Ogden UT	Tucson AZ	
San Antonio TX	Tulsa OK	
San Diego CA	Utica-Rome NY	
San Francisco-Oakland-San Jose CA	Washington-Baltimore DC-MD-VA-WV	
San Juan PR	West Palm Beach-Boca Raton FL	
Santa Barbara-Santa Maria-Lompoc CA	Wichita KS	
Scranton-Wilkes Barre-Hazleton PA	York PA	

Source: Alternative Fuels Hotline extrapolation of 1980 US Census data.

a data base on fleets for the enhanced I/M program may aid state government staff in tracking fleet emissions and compliance with EPact and CAAA.

MONETARY INCENTIVES

Monetary incentives provided in EPact are intended to soften the impact of AFV requirements on the private sector. Section 1913 of

EPact allows tax deductions for clean fuel vehicles beginning October 24, 1993. The fleet owners are allowed a tax deduction up to \$2,000 per LDV or LDT under 8,500 lb. GVWR. Tax deductions of up to \$5,000 per truck or van are allowed in EPact for vehicles greater than 8,501 lb. and less than 26,000 lb. For those entrepreneurs building commercial and public alternative refueling stations, property tax deductions of up to \$100,000 are allowed until 2002, phasing out the deductions by 2004.

TABLE 4 EPact and CAAA Purchase Requirements in Percentages

	Fed	Fuel	State	Private/	CAA 90	C A A
	Govt	Providers	Govt	Local*	LDV	90 HDV
1996	25	30	10	-	-	-
1997	33	50	15	-	-	-
1998	50	70	25	-	30	50
1999	75	90	50	20	50	50
2000	75	90	75	20	70	50
2001	75	90	75	20	70	50
2002	75	90	75	30/20	70	50
2003	75	90	75	40/40	70	50
2004	75	90	75	50/60	70	50
2005	75	90	75	60/70	70	50
2006	75	90	75	70/70	70	50

* Pending DOE rulemaking

Source: EPA

MODEL YEAR COVERAGE PERIOD

The main thrust of the clean fuel fleet provisions under CAAA and EPact is to require fleet owners to purchase a certain percentage (Table 4) of their new fleet vehicles as clean vehicles operating on alternative fuels. An important consideration for government and private fleet owners to understand is when to begin complying with the new laws. For the purpose of this regulation, EPA defines model year as the time period from September 1 to August 31. Because the CFFV provisions under CAAA go into effect January 1, 1998, an affected fleet owner needs to compute its CFFV purchase needs on the basis of the particular budget cycle that covers September 1, 1997, through August 1, 1998. It is assumed that DOE will define model year similarly to EPA. If the EPA definition is adopted for EPact, the 10-percent CFFV purchase for MY 1996 would have to be in place by September 1, 1995. Because the DOE rules affecting state fleets and private fuel provider fleets were not released until late 1994, a delay in new fleet purchases for these two regulated entities may have been prudent.

CONVERSION KIT VEHICLES

A vehicle originally designed to run on gasoline may be retrofitted with a conversion kit to run on an alternative fuel either as a dedicated alternative fuel vehicle or a dual-fueled vehicle capable of operating on either the conventional or alternative fuel. DOE may issue further guidance on the use of dual-fueled vehicles to comply with EPact, but it has yet to do so. EPA allows the CFFV purchase requirements to be met by converting existing or new gasoline-powered vehicles to clean fuel vehicles. The conversion kit will have to meet EPA engine-class certification standards of the LEVR program. An actual converted vehicle will have to pass the I/M test. Enhanced I/M operators are encouraged to find ways to measure emissions accurately from CFV/AFVs to provide SIP credits to state govern-

ments. A dual-fuel vehicle must meet the emission standards of the alternative fuel and the fuel to which it was originally certified.

EPA has indicated that an existing converted vehicle may qualify as a CFFV if it can be recertified to LEVR/CFFV emission standards. It is anticipated that post-September 1994 conversion kit manufacturers and installers will certify kits to LEVR standards, but existing conversion vehicles possess no such certification. Thus, they would have to be tested, probably via the federal test procedure, to receive certification, at an approximate cost of \$2,000 per test. To achieve LEVR emission standards, most existing conversion vehicles would have to operate on or be upgraded to closed-loop systems (a feedback system operated by an advanced digital processor computer that meters the air-to-fuel ratio for optimal combustion). The costs for such a system are estimated to be \$500 to \$1,000 per vehicle, including labor. In cases in which an organization has existing conversion kit vehicles, it should be determined whether the kit has passed the EPA certification test and whether it has a closed-loop stoichiometric device. If the existing conversion vehicle does not have both of these features, it is more cost effective to buy an OEM vehicle or a new certified conversion kit that includes the closed-loop device. Recertifying existing conversion vehicles or transferring existing conversion kits to other vehicles is not cost effective at this time for meeting CAAA requirements.

Alternative fuel enhanced I/M testing is an area in which research needs to be conducted immediately. The Flame Ionization Detector, used in the new enhanced I/M programs to measure the NMOG fraction, samples propane to compute emission levels. Apparently, propane is not a significant enough component of most alternative fuels (particularly gaseous fuels, the fuels leading the way in existing production, infrastructure, and new purchase demand) to sample for NMOG concentrations. Proper NMOG sampling would more accurately generate CFV emission credits for the fleet operator and for state SIP credit.

It would not be prudent to exempt alternative fueled vehicles from I/M programs and assume that they meet the LEVR standards

without ongoing inspection and, if necessary, maintenance. For ozone nonattainment areas that may demonstrate problems maintaining the EPA enhanced I/M performance standard after the turn of the century in a biennial program, the ability to test fleet emissions and receive SIP credit for additional fleet emissions reductions will remain important.

SELECTING AFV/CFFV

Usually, state fleets are made up primarily of compact sedans but also include mid-sized station wagons, 1/2-ton trucks, compact pickup trucks, 5-passenger vans, and mini-cargo and passenger vans. AFVs are available for each of these vehicle types, although AFVs are not available in all fuel types per vehicle category. For example, currently available methanol vehicles are almost exclusively sedans. LPG vehicles are primarily vans and medium-duty trucks. Fuel choice will depend on available and planned fuel infrastructures, as well as the desired LEV rating of the vehicle. On a national scale, DOE's Alternative Fuel Data Center reports that most state-planned AFV purchases are for CNG vehicles.

There are currently two fuel choices for compact sedans: M-85 and CNG. Wagons, vans, and trucks are also generally available in only two fuel choices: CNG and LPG (electric vans are still largely experimental and too costly). The additional initial purchase cost per alternative fuel vehicle is approximately

- CNG retrofit, more than \$1,600;
- Dedicated CNG, more than \$800;
- CNG van/wagon, more than \$5,000;
- LNG retrofit, more than \$2,780;
- M-85 sedan, more than \$150;
- LPG medium-duty truck, more than \$800; and
- Electric/hybrid small van, more than \$80,000.

These costs, primarily provided by OEMs, are estimates and highly uncertain. (For specific fleet sales information contact the American Automobile Manufacturers Association.) An Air and Waste Management Association paper, *Alternative Fuel Vehicles for the Department of the Navy*, found incremental purchase costs of \$400 for an M-85 vehicle, \$800 for a LPG vehicle, and \$1,000 for a CNG vehicle.

Another factor that may determine vehicle choice is vehicle operating range. A typical CNG sedan generally has a range of 80 to 110 mi (a dual-fuel sedan would probably have one CNG tank, and a dedicated sedan would have two tanks) or about 40 percent the range of a gasoline vehicle. A Ford Ranger CNG pickup truck has a range of 225 mi with four CNG tanks. CNG has a 3.2-to-1 volume disadvantage at 3,000 lb/in.² compared with gasoline. LNG has only a 1.3-to-1 volume disadvantage compared with gasoline. LNG is thus more favorable in terms of volume disadvantage. However, because of space limitations, refrigeration of the LNG to keep it in a liquefied state may only initially become available for buses. LPG delivers about 50 percent of the mileage range compared with gasoline on a mile per gallon (MPG) basis. Methanol vehicles deliver 60 percent on an MPG basis of the equivalent gasoline vehicles. Electric vehicles deliver 12 to 55 percent the range of gasoline vehicles, depending on the battery type. A new energy storage device is the flywheel-based electromechanical battery. Electricity is converted into rotational energy for storage by a motor/alternator device using magnets and electromagnetic pickup coils. Industry awaits the

unveiling of a functional prototype vehicle. In the near term, however, it appears that CNG has the most extensive refueling infrastructure. Hence, many areas are initially leaning toward CNG.

FUEL COSTS

Although natural gas is often less expensive than gasoline, new federal legislative initiatives may tax alternative fuels so not to have a negative effect or impact on the National Highway Trust Fund. CNG costs average about \$0.74 a gallon and are generally less expensive than LPG. Methanol is usually the most expensive fuel. The Office of Technology Assessment estimated methanol prices to range from \$1.29 to \$1.71 per gasoline gallon equivalent in the early years of AFFV/CFFV program implementation. Electricity is estimated to cost about \$1.50 per gallon equivalent. Ethanol may range from \$1.60 to \$2.60 a gallon. The RFG renewable oxygenate mandate could create ethanol supply problems because of ethyl tertiary butyl ether (ETBE) production. As of mid-1994, not many ETBE plants are in production. However, new plants are planned that can produce ETBE, corn syrup, and other corn byproducts to keep the facilities flexible and profitable.

MAINTENANCE

Many AFV OEMs plan to offer maintenance services through their local dealerships. M-85 has some special maintenance considerations: it requires a unique oil and oil change interval (comparable to Schedule A for gasoline vehicles). Because of their corrosive nature, alcohol fuels may remain less attractive until an additive is found to offset the problem. LPG vehicles generally have reduced oil change frequency of 50 percent compared with gasoline vehicles and longer spark plug and engine lives. OEMs report no substantial maintenance differential for CNG vehicles as compared with gasoline vehicles. Under CAAA, states may require more frequent tune-ups of CFFVs (and certification of such tune-ups) to ensure compliance with emission standards certified by the OEM or conversion kit manufacturer.

RECENT STATE EXPERIENCE

At present, most states have experience with experimental programs operating on CNG, often in a dual-fuel mode with gasoline. A few of the positive points from this experience are

- Cleaner air quality effects,
- Increased range of a dual-fuel vehicle,
- Absence of fuel spills during fueling, and
- Absence of fuel evaporation into the atmosphere.

Some negative aspects of CNG use are

- Tuning vehicles to operate on two fuels,
- Working with high pressure,
- Retraining of operators and mechanics,
- Present lack of standards for fuel connections, and
- Initial cost of the program.

CONCLUSION

The implications of fleet provisions in CAAA and EPact are important to the public and private sectors. Although the geographic coverage of CAAA fleet provisions is less than EPact, it is viewed as more stringent. Areas covered by CAAA fleet provisions should more easily comply with EPact provisions. Beginning in 1996 CAAA areas must also comply with the EPact provisions. In those places not affected by CAAA fleet provisions but by EPact, communication, coordination, implementation, and compliance with the fleet provisions will be complicated by the earlier 1996 MY start date. The tight time frame between DOE's final rulemaking and a fleet operator's purchasing needs is important to consider. (A Notice of Proposed Rulemaking for state government fleets and fuel provider fleets was scheduled to be released in November 1994. Consult with the regional DOE office for clarification.) Fortunately, only 10 percent of new fleet vehicle purchases are required to be alternatively fueled in the first year of the program in 1996. Of course, a fleet owner could simply forgo buying or replacing vehicles for 1996.

That EPact is both geographically more pervasive and 2 years earlier than CAAA presents great challenges and opportunities. The challenge is to develop an alternative fuel infrastructure in a great number of U.S. cities in the next 2 years while the government attempts to be fuel neutral. The congressional goal of reducing U.S. oil import dependence for transportation is driving this process.

If alternative fuels are not taxed the same as gasoline, the National Highway Trust Fund, which funds federal and state transportation agencies, is in danger of losing a portion of its solid user fee base derived from the federal gasoline tax. This issue need not concern states if they are willing to replace the existing gasoline tax and user revenues with other sources of revenues, such as registration fees or possibly in the future congestion/emission pricing user fees. However, the public might have a difficult time understanding the nuances and changes in highway funding and probably would resist the pricing initiative without an educational campaign similar to those in the past for safety belts and recycling.

Recent changes in federal law may affect the National Highway Trust Fund. Congress may choose to resolve how to continue funding transportation agencies while providing an incentive to use alternative fuels in the early years of the program, when the risks may appear to outweigh the benefits.

The opportunity presented by the earlier implementation of EPact is the generation of credits in air quality nonattainment areas to apply toward the annual rate of progress in reducing ground-level ozone. For those nonattainment areas trying to determine whether quantifying fleet MERCs is worth the effort in its rate of progress report, they should consider that a fleet vehicle averaging 20,000 mi annually, merely going from NMOG Tier 1 standards (0.25 g/mi) to ULEV NMOG standards (0.04), provides an 84 percent reduction in NMOG, or about a 23 kg/day reduction per 2,000 vehicles. This is approximately a 38-ton-per-day reduction for an area with 3 million ULEV vehicles. Note that actual SIP credit must reflect actual vehicle and fleet emissions and not those specified by the LEVR program (consult MOBILE5).

Nonattainment areas that have been designing EPA's new enhanced I/M programs may have an extensive data base on fleet operators to properly serve fleets in the I/M program. It should be possible to track fleet emissions reductions after 1996 with this data base. State vehicle registration records may not accurately reflect the number of fleets affected, however, because of the voluntary nature of fleet registration and fleet size thresholds. This is further complicated by CAAA fleet-use levels, measured in miles driven in the nonattainment area, which are often not included in current records and complicate enforcement without a computerized trip-log or constant emission monitoring (CEM) type equivalent. This situation is complicated in multiple state metropolitan areas where one of the states may have replaced the CFFV requirement with another program, as was allowed in CAAA. Fleets promise an interesting way to quickly introduce CFVs/AFVs and for fleet owners or state governments to claim the extra emissions reduction credit. An important point for states and private fleet owners is that, unless dedicated fuel vehicles are chosen, they receive very little credit from EPA for the CFFV program. Without an extensive infrastructure in place, fleet owners may be reluctant to purchase more than the required percentage of CFVs or to choose dedicated fuel CFVs. Large commercial interests in urban areas should find it easier to purchase dedicated fuel vehicles because their fleets have a more local operating range. A central refueling facility or a series of them in the urban area should make it easier for dedicated fuel vehicles to operate in urban areas. State fleets and fleets with a wider operating range may prefer to purchase dual-fueled vehicles to avoid the complication of limited refueling facilities during the early years of the programs.

Of more interest, in terms of generating emissions credits, is the maximum credit I/M program, which would return fleet vehicles to near-engine-emission certification levels. This program could yield between 0.6 and 1.2 g/mi VOC reduction, approximately 66 to 132 kg/day per 2,000 vehicles, each driven 20,000 mi/year. A maximum I/M program applied to 3 million vehicles would yield 109 to 218 TPD VOC reduction. The maximum I/M program is clearly an aggressive program, three to six times more stringent than a total ULEV program applied to the entire population. Although, the general public may not approve such a program for all vehicles, it may endorse it specifically for fleets.

Perhaps in the future, ozone nonattainment areas may have difficulty complying with the EPA enhanced I/M performance standard in a biennial testing program. States would have the following choices to remain in compliance:

- Lower slightly the cut-points of the I/M program,
- Adopt a maximum credit I/M program,
- Adopt a LEVR program for the entire vehicle population, or
- Make the I/M program annual.

Before this occurs, states should examine the emissions reductions to be obtained by administering and enforcing the CFFV program and, if necessary, applying the maximum I/M program to fleets instead of the entire vehicle population.