

Clean Fuel Technology and Energy Independence

Editor's Note: In this installment, author Bob Rodriguez looks at some of the successes and challenges of recent U.S. energy policies as well as some proposed solutions and technologies.

Since 9/11, people are again concerned about U.S. dependence on imported oil. It's no secret that much of our oil comes from unstable economic or political regions of the world, and fears of political instability drive up the cost of oil. Recent government policies are encouraging both a diversity of supply and a broad mix of supply options to help lessen American dependence on imported oil. DOE Secretary Spencer Abraham has emphasized the importance of energy supply diversity. Let's look at some of the nation's policy issues and some short-term alternatives to the use of petroleum.

EPAct 92 and Light-Duty Vehicle Alternatives

Early efforts included Congress' Energy Policy Act of 1992 (EPAct 92). Its purpose was to reduce U.S. oil importation and foster U.S. energy independence through the use of alternate fuels in light-duty vehicles. Under EPAct, federal, state and local government fleets, energy providers and others were mandated to purchase ever-increasing numbers of alternative fuel vehicles (AFVs) for fuels other than petroleum. These fuels include propane, natural gas, hydrogen, ethanol, methanol, electricity, and more recently bio and synthetic diesel.

But EPAct has had limited success, as documented in a report from the Government Services Administration (GSA)¹ (Refer to Notes at end of article.)

Fleets attempting to comply with EPAct have run into a variety of roadblocks, including: 1) the higher (incremental) cost of AFVs over conventional gasoline and diesel vehicles; 2) bi-fuel and electric vehicle technical problems; 3) non-

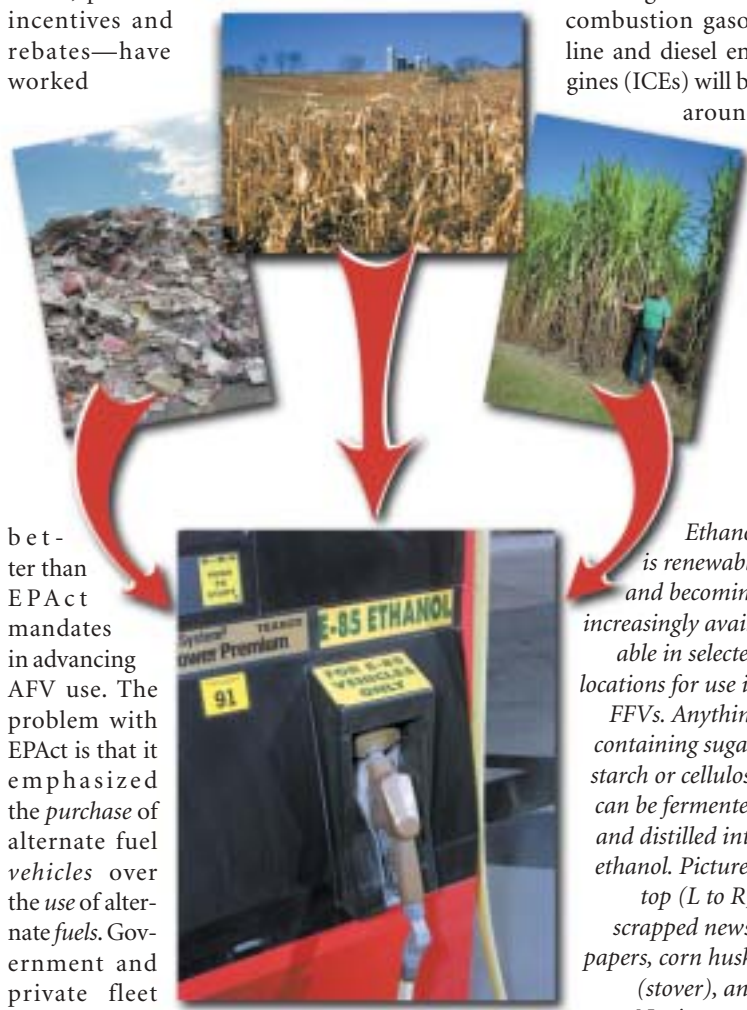
EPA compliance of converted vehicles and the subsequent tightened restrictions which drove vehicle conversion outfitters out of business; 4) the absence of OE models desired by fleet owners; 5) the lack of alternate-fuel filling stations for CNG, propane, ethanol, methanol and electrical charging stations; and 6) low gasoline prices at a time of deregulation (tighter budgets) of alternative fuel energy suppliers.

On the positive side, financial incentives—grants through Clean Cities, plus tax incentives and rebates—have worked

Breaking the Stronghold – Ethanol

The aforementioned GSA report suggests that EPAct's scope be broadened from exclusively promoting alternate fuel vehicles to include ways to use alternate fuels and ways of reducing the use of petroleum fuels. Strategies include stricter CAFE requirements and financial incentives towards purchasing more fuel-efficient gasoline vehicles such as hybrids.

By all projections, liquid fuel burning internal combustion gasoline and diesel engines (ICEs) will be around



better than EPAct mandates in advancing AFV use. The problem with EPAct is that it emphasized the purchase of alternate fuel vehicles over the use of alternate fuels. Government and private fleet managers who purchased

methanol- and ethanol-burning FFVs to comply with EPAct learned that with the absence of appropriate filling stations, the vehicles would only be run on gasoline. Moreover, owners of bi-fuel CNG or propane vehicles hoping to take advantage of lower fuel prices found many of their drivers opted for gasoline out of habit, fear, or simply the closer proximity of gasoline stations.

for years serving our nation's needs. High BTU content gasoline and diesel fuel powers these vehicles, but alternate motorfuels can keep these vehicles rolling with most often no modifications required. EPAct recognizes domestic renewable / sustainable fuels from cultivated energy crops, from landfill, industrial and agricultural waste, and so on. Such feedstocks are presently being used to make (liquid) alternative fuels for ICEs. (The merits of ethanol were discussed in detail in the Summer 2000 issue of ASE TechNews.)

According to the Energy Information Agency, there are over 2,000,000 flexible fuel vehicles (mostly light-duty) registered for use in the U.S., yet few owners or technicians realize these vehicles can use ethanol. Through additional research and economies of scale, the cost / benefits ratio for using renewable fuels will only make them increasingly competitive with petroleum, especially as oil prices go up. Fleets, in particular, seem poised to benefit from a quick return-on-investment, given their high annual fuel consumption combined with centralized refueling.

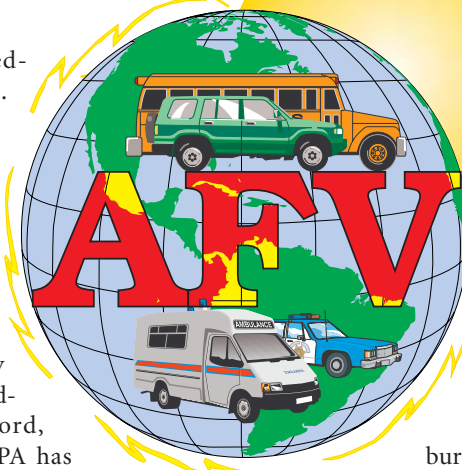
Some advocates suggest that the U.S. should make a rapid transition to high MPG hybrid-electric vehicles like those now on the market, but which can use domestically supplied ethanol made from energy crops, re-

cycled feedstocks, etc. According to the National Ethanol Vehicle Coalition, such vehicles have "... recently been considered by Ford, and the EPA has begun to evaluate the vehicle's alcohol compatibility. Rollout of an E85/Electric Hybrid is expected in about five years."²

Breaking the Stronghold – Bio and Synthetic Diesel

EPAct focuses on light-duty vehicle applications. But diesel engines mostly power larger on and non-highway applications. Likewise, jet aircraft engines burn JP fuel—a derivative of diesel fuel. It is said that every minute in the U.S., 44,000 gallons are burned in diesel trucks alone, hauling products and goods to and within markets. If no other fuel does as much 'mobile work energy' as diesel, why not use alternative diesel fuels instead of petrodiesel to help displace imported oil? Both bio-based and synthetic fuels are compatible with petrodiesel. They may be used 100% (neat) in place of petrodiesel, or may be blended with petrodiesel. According to the National Biodiesel Board, vehicles that operate on a blend of 20% biodiesel with 80% petrodiesel (B20) will, on the average, displace more than twice as much petroleum as conventional light-duty passenger vehicles already covered under EPAct. The biofuels industry lobbied for biodiesel to be considered an alternate fuel, and in January 2001 the DOE published the final rule for use of biodiesel to fulfill EPAct requirements.

Biodiesel is renewable fuel made by chemically combining natural oils from soybeans (or cottonseeds, canola, etc.; animal fats, or even recycled cooking oil) with an alcohol such as methanol (or ethanol). Biodiesel fuels are usually more ex-



ensive than petrodiesel, but biodiesel

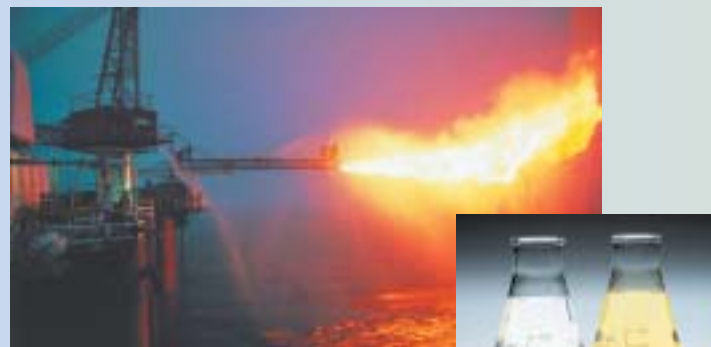
burns with less particulate and with no sulfur or aldehydes, producing less harmful and irritating tailpipe emissions. NO_x sometimes increases with biodiesel, but after-treatment devices benefit from the lack of sulfur in biodiesel. The improved lubricity and zero sulfur content of bio and syndiesel result in longer maintenance intervals, longer engine and fuel system life, and lower emissions. (See below.)

Where some prefer B100, others say mixtures over 20% bring diminishing relative clean air benefits. With B100, drivers may notice a slight reduction of fuel economy and engine power compared to #2D. B20 will increase cold flow properties (cold filter clogging, pour point) by approximately 3 to 5 degrees F, but reportedly few have unusual problems when bio is blended with #1 diesel. B100 may affect (older) fuel system hoses and pump seals containing elastomer compounds. Biodiesel tends to clean petrodiesel residues from the fuel system, so fuel filters may require frequent servicing for the first few tank fills. Reportedly, bio/petrodiesel blending standards are not finalized and more tests under various temperature conditions may be needed. "Splash blending" at the point of sale helps keep infrastructure costs down.

The DOE actively funds research to improve processes for converting domestically abundant feedstocks into alternate fuels and bring costs down (see Summer 2000 TechNews). Even a small percentage of bio or synthetic diesel blended on

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According to industry sources, each year more than 15 trillion cubic feet of stranded natural gas is burned, vented, or re-injected into producing formations. Using gas-to-liquid (GTL) technology, presently wasted natural gas could be converted into a variety of fuels to yield an additional 1.5 billion barrels of petroleum equivalent per year.



Both synthetic and biofuels are biodegradable and non-toxic and can be made from a variety of feedstocks. Here, Fischer-Tropsch gas-to-liquid fuel from natural gas (left), and 100% BioDiesel (right) from soybeans, canola, etc. Used cooking oil is also used—its exhaust reportedly smells like french fries, but does not attract animals.

Low Sulfur Diesel Fuel and Its Implications

Since 1993, regulations limit sulfur content in petroleum diesel fuel for highway use to 500 parts per million (ppm) by weight. Non-road diesel fuel sulfur ranges from 2500–5000 ppm and presently averages around 3000 ppm. We'll see a substantial reduction of sulfur in on-road petrodiesel fuel to 15 ppm sulfur in 2006. Vehicle OEs support low sulfur diesel, stating it's needed to make use of after-treatment technologies and to pull ahead of advancing clean diesel technology. If sold here, the highly popular and fuel-efficient diesel automobiles selling in Europe could help us reduce oil consumption, but they cannot meet EPA restrictions without the use of low sulfur diesel. Likewise, advanced technology diesel engines developed for the 80+ MPG Partnership for a New Generation of Vehicles (PNGV) rely on low-sulfur diesel, and could find their way into production autos.

Unfortunately, it's the sulfur in petrodiesel fuel that helps provide lubricity (lubricating qualities) for diesel injection system components, but removing sulfur by hydro-processing tends to reduce lubricity. Without adequate lubricity, moving parts in the injection system will seize. Refiners are adding petroleum-based additives, but a 1–2% addition of biodiesel restores needed lubricity. SAE Standard J-2265 defines lubricity standards for diesel fuel used in North America.



AUTO TRAINING RESOURCES



Federal Mogul Technical Education Center Field Seminar Information Available on Web

Four-week calendars for Federal Mogul's Technical Education Center field seminars in the United States and Canada are found on their website and are updated weekly. The calendars include seminar date, topic and description, sponsor, location, key contact and registration phone number.

The evening seminars are designed for the professional technician and machinist. Seminars are three-hour long evening technical presentations held in local marketing areas and are presented by Federal Mogul's ASE Master Certified instructors from the Technical Education Center. Seminar subject matter includes:



- Electronic and advanced steering/suspension systems
- Late model ABS systems and advanced brake diagnostics
- Ignition systems on OBD-II vehicles
- Advanced fuel system troubleshooting
- Engine systems
- Advanced engine sealing systems

Each attendee receives a seminar workbook and seminar packet, plus new information enabling them to tackle new challenges and opportunities in a productive and profitable manner. Since each seminar is typically sponsored by a jobber or WD, the cost to attend varies based on the sponsorship.

For more information, go to: www.federal-mogul.com/training and click 'Field Seminars.'

National Alternative Fuels Training Consortium (NAFTC)

This spring the National Alternative Fuels Training Consortium (NAFTC) will introduce their new *Heavy Duty Gaseous Fuels* training course. The course will provide automotive and truck technicians with training in maintaining gaseous-fueled engines and lean-burn technology.

NAFTC

National Alternative Fuels Training Consortium

Through a network of educational institutions across the country, the NAFTC does AFV training, education, and consumer awareness activities, and, presently, offers the following technician training courses:

- Alternative Fuel Vehicle Overview
- Natural Gas Vehicles: System Integration and Service
- Natural Gas Vehicles: CNG Cylinder Inspection and Certification
- Propane Vehicle Training
- Forklift and Material Handling Equipment and Transient Emission Testing

NAFTC, headquartered at West Virginia University, develops curricula and delivers standard, competency-based training to students, fleet managers, automotive trainers, pre- and in-service technicians and others in the Alternative Fueled Vehicle (AFV) market. Additional NAFTC training projects under development include an Electric and Hybrid Vehicles Technician's Guide; Electric and Hybrid Vehicles: Fleet Manager's Guide; On-Board Diagnostics II; and Liquefied Natural Gas Technicians Training Manual

Information about NAFTC courses and training materials can be found at: <http://naftp.nrcce.wvu.edu> or by contacting the NAFTC at 304-293-7882.

Training Alternatives Offers Emotional Intelligence (EQ) Training for Shop Owners, Managers, Supervisors, and Technicians

Training Alternatives, Inc. provides a Relationship Power Self-Development Program based on

Emotional Intelligence (EQ). Emotional Intelligence is the ability to be aware of, make sense of, and make use of emotional and social competencies to guide thinking and actions with others and ourselves.



Developed by Training Alternatives' partner, professor and author Dr. Michael Rock Ed.D., the course is based on human performance research showing that the so-called 'soft skills'—the ability to lead others, to communicate, and to accommodate change, for example—contribute greatly to career and personal success.

People who display superior Emotional Intelligence are able to 'super-charge' their own performance with their proficiency at self-management. They are extremely aware of themselves to change and adapt their behavior even under high stress conditions. In addition to extremely proficient self-management, people with high EQ have an extraordinary ability to understand, build, and maintain strong relationships with others, both on a personal and professional level, claims the company.

The complete 15-module self-development Emotional Intelligence course is available on-line through Training Alternatives' e-commerce products section. The package includes the initial EQ-i™ assessment, which provides you with a pro-

file of your relative strengths in a hard-copy EQ Development Report. Users get password-protected access to the program 24 hours a day, 7 days a week for 6 months, an 'EQ Log' to record their progress through the program, and an EQ Recognition of Achievement Certificate after successful completion. Payment can be made securely by credit card on-line or by traditional means.

For more information, go to www.trainingalternatives.com, or call Training Alternative Inc. at 416-598-1795.

The 15 Emotional and Social Competencies of Emotional Intelligence:

- | | |
|--------------------|--------------------------------|
| 1. Self-awareness | 8. Independence |
| 2. Empathy | 9. Social Responsibility |
| 3. Assertiveness | 10. Optimism |
| 4. Reality Testing | 11. Stress Tolerance |
| 5. Impulse Control | 12. Self-Actualization |
| 6. Flexibility | 13. Problem Solving |
| 7. Self-Regard | 14. Interpersonal Relationship |
| | 15. Happiness |

'Shop Management Tools for Success' Available from MACS Website

The Mobile Air-Conditioning Society (MACS) Worldwide offers shop owners a three-part management course. Materials include three Manuals, five Videotapes, and a Guide Book.

Part One (two videotapes and one manual) covers Profit Structure and Shop Layout and Management in depth. Part Two (two videotapes and one manual) offers strategies and procedures on Service Writing and up-

selling for greater profitability.

Part Three (one videotape and one manual) shows shop owners how

to find, motivate, and develop technicians and other employees.

Also included is a 278-page book, *Shop Management Tools for Success*, written by course instructor and author, speaker, and consultant, Art Vasconcellos and produced by Automotive Video, Inc./Team AVI www.auto-video.com.

\$369.95 (Member Price: \$339.95)

For further information contact Maria@macsw.org or order directly from MACS website at www.macsw.org.



Alt Fuels

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a large scale with petrodiesel would benefit not only energy independence, but also the environment—and help the sagging farm economy. Recognizing this, Minnesota has already passed a law requiring that

petrodiesel fuel sold in the state shall include 2% bio effective in 2005.³ At least one OE suggests blending no more than 5% pending further tests,⁴ and the biodiesel industry will likely lobby for a nationwide 5% mandate. There are reportedly over 100 major fleets operating on B-20; 75 are a part of the Federal Govern-

ment.⁵ Check out the many companies on the Internet supplying bio and synthetic fuels and blends to the marketplace for

ICEs.⁶ One of the more promising "gas-to-liquids" (GTL) technologies, known as Fischer-Tropsch (F-T) dates back to the '20s and WWII. More recently, thanks to processing breakthroughs, abundant natural gas (plus coal or other feedstocks) can reportedly now be economically converted into liquid F-T fuels.⁷ According to University of Kansas researchers, "Preliminary engine tests indicate that these [F-T] formulations are probably the best liquid fuel that has ever been recorded for use in a diesel engine."⁸ Another company reportedly has developed a different GTL process for converting natural gas into various clean fuels, using physically smaller processing facilities.⁹

It's not a case of whether we will be using the alternatives to petroleum as discussed above, but when and to what degree. The reasons are compelling: energy security, the cost of importing and defending oil interests, reduction of the trade deficit, renew-

able/sustainable supply, domestic economic development, global warming, etc. We as automotive technicians, educators and industry partners have the opportunity (and challenge) of adapting to these alternative technologies. The more we

learn about how engineers—and policy makers—are introducing these alternative fuels into the petroleum mainstream, the better prepared we'll be to discuss these new technologies with our family, friends, and customers.



Look at the fill cap! Drivers of Ford flexible-fuel vehicles (FFVs) will see 'ethanol fuel' listed at the fill cap; DaimlerChrysler FFV minivan drivers will see simply 'E85'. An estimated 2,000,000 ethanol burning FFVs are driven in the U.S., but most FFV owners don't know their vehicles can use ethanol.



Footnotes and Where to Get More Information

1. "Energy Policy Act of 1992 Limited Progress in Acquiring Alternative Fuel Vehicles and Reaching Fuel Goals"; GAO/RCED-00-59 February 2000.
2. NEVC July 30, 2002 – editorial.
3. *Inside Fuels and Vehicles*, May 23, 2002: www.fuelsandvehicles.com
4. International Truck and Engine Corp. publication: SSM 13-12-01 of 12/15/2000.
5. As of 2001, according to the National Biodiesel Board: www.biodiesel.org.
6. These include (but certainly not limited to) products from Advanced Fuel Solutions, International Fuel Technology Corp., Pacific BioDiesel, Pure Energy, Syntroleum, Worldenergy, and many more. One ethanol-based fuel, Escalene, is touted to be produced for less cost from "any material containing carbon and hydrogen" whether waste crops or landfill: www.powerenergy.com.
7. F-T seems to hold great promise as a substitute for petrodiesel: <http://www.epa.gov/otaq/consumer/fuels/altfuels/fischer.pdf>
8. Go to www.ur.ku.edu/News/98N/OctNews/Oct20/fuel.html
9. SynFuels International: www.synfuels.com.