

Putting Advanced Transportation Technologies to Work for Clean Air and Energy Security

The Mobile Source Technical Review Subcommittee

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U.S. Department of Energy

Overview



- ✧ **Why Use Alternative Fuels?**
- ✧ **What Alternative Fuel Vehicles are Available Now?**
- ✧ **Alternative Fuel Vehicle R&D Challenges**
- ✧ **Advanced AFVs and Hybrid Vehicles**
- ✧ **Vision for Transportation Deployment Programs**
- ✧ **Selected Transportation Deployment Policies**
- ✧ **The Energy Policy Act (EPACT)**
- ✧ **Federal Promotion of Clean and Efficient Vehicles**

Why Use Alternative Fuels?

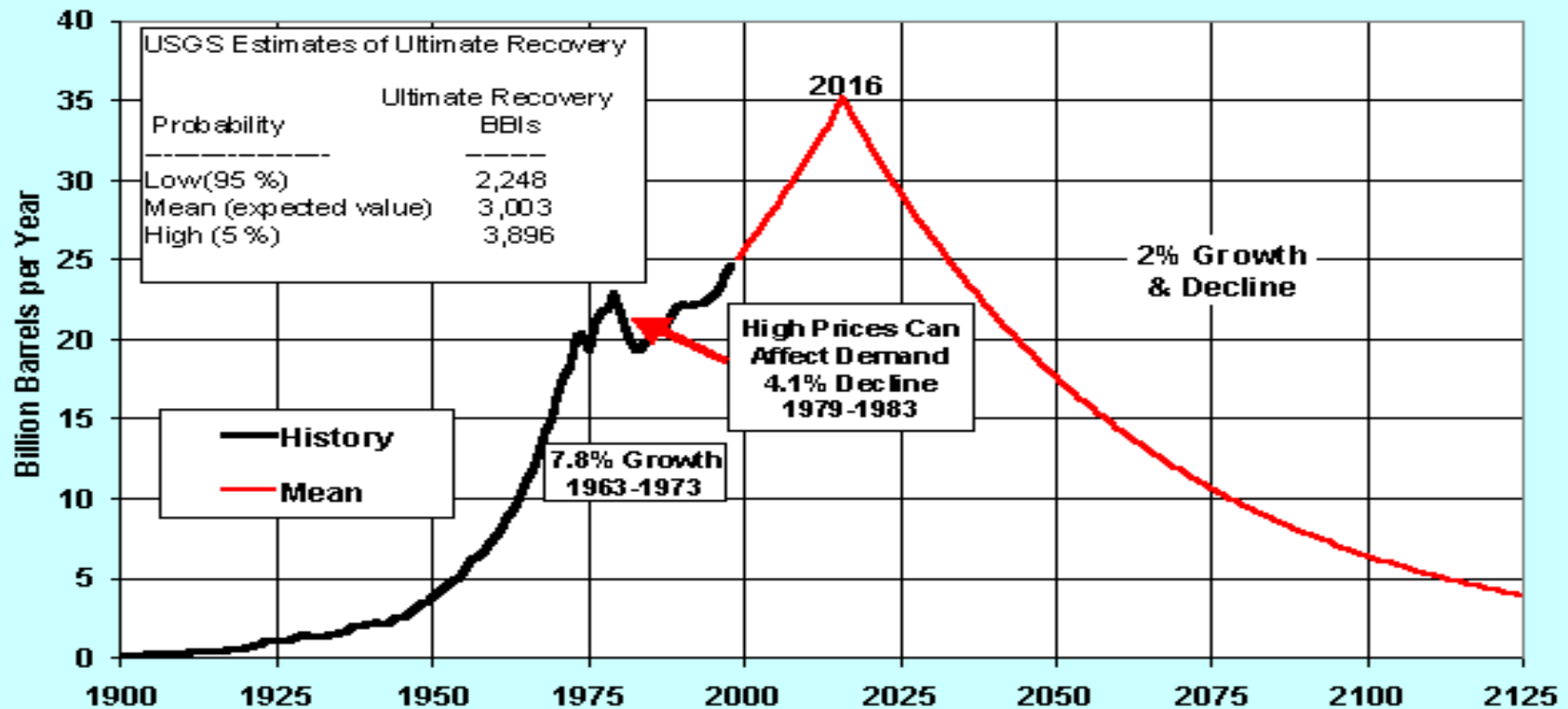


- ✓ **Petroleum Displacement**
- ✓ **Energy Diversity**
- ✓ **Air Quality Improvement**
- ✓ **Greenhouse Gas Emission Reductions**
- ✓ **Domestic Economic Development**

Estimated World Oil Supply



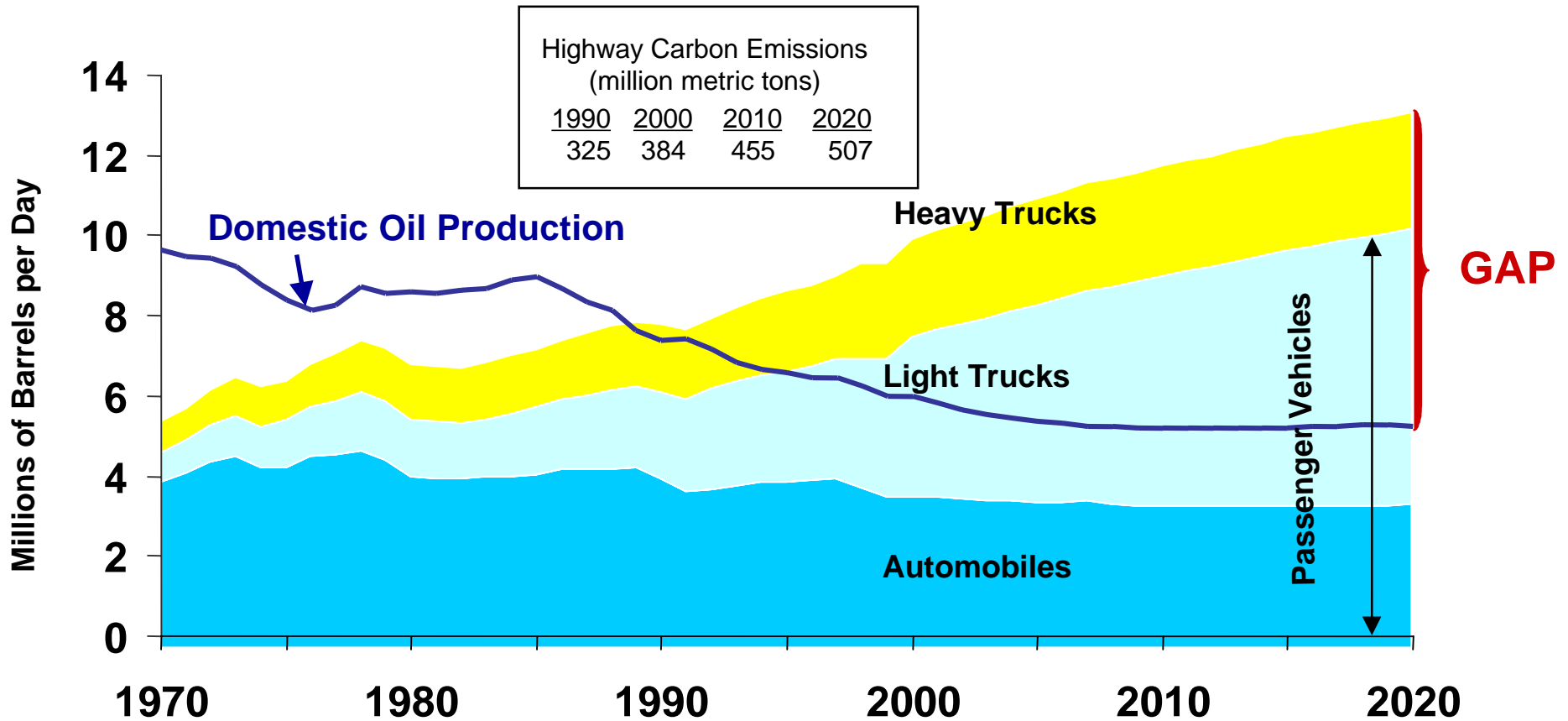
Annual Production with 2 Percent Annual Growth & Decline



Note: U.S. volumes were added to the USGS foreign volumes to obtain world totals.

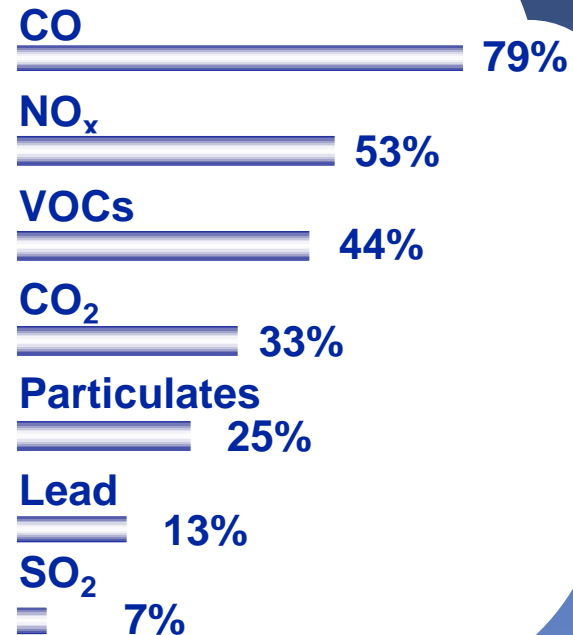
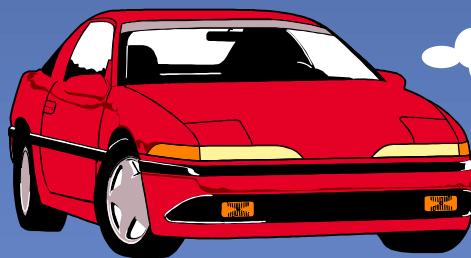
Source: EIA, Long Term World Oil Supply, July 28, 2000.

U.S. Transportation Oil Demand



Source: Transportation Energy Data Book: Edition 19, DOE/ORNL-6958, September 1999, and EIA Annual Energy Outlook 2000, DOE/EIA-0383(2000), December 1999

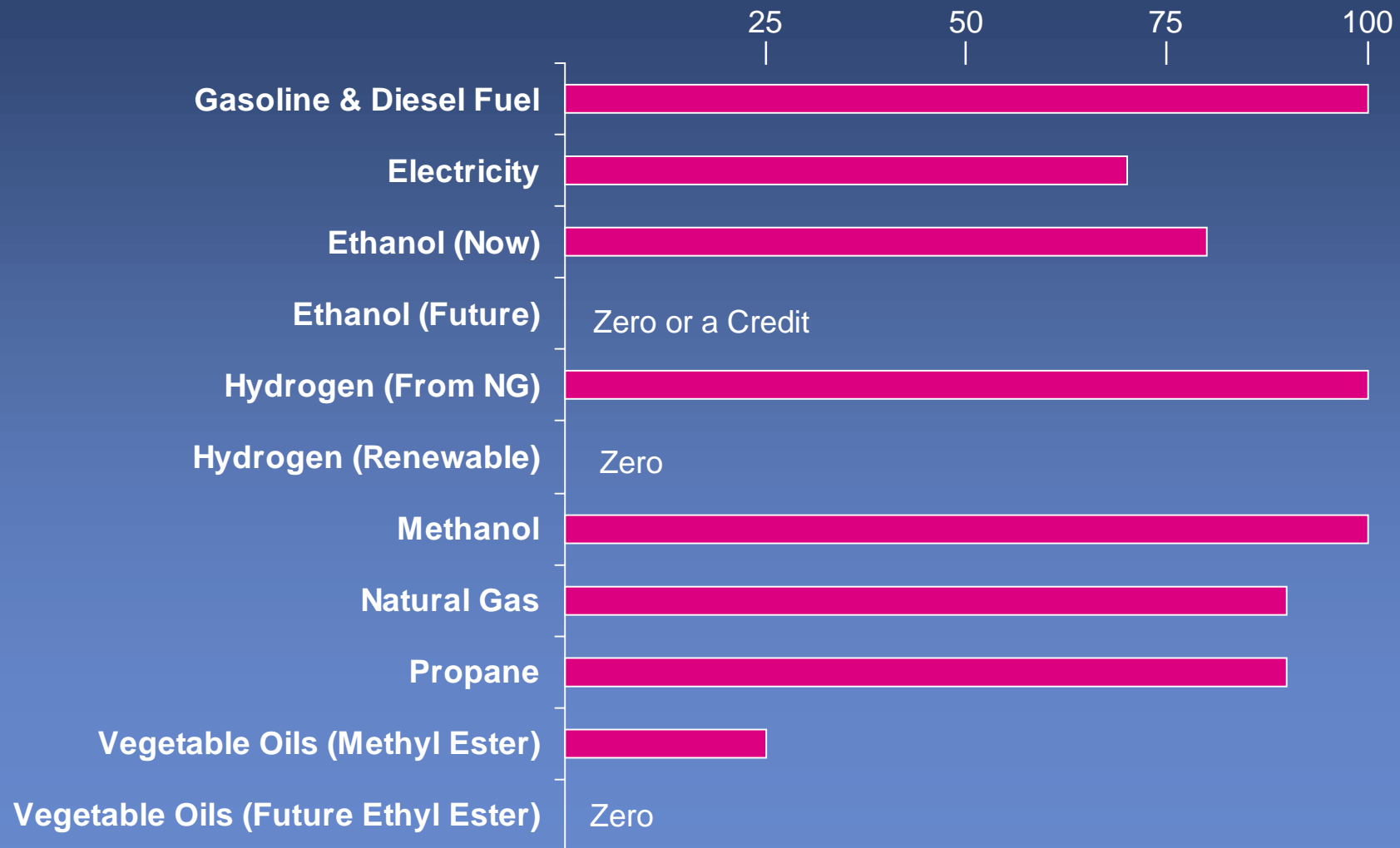
Transportation Share of Emissions



- Still a major contributor, despite reductions in new vehicle emissions achieved over the last decade

Source: EPA

Relative Greenhouse Gases



Summary of Present Situation



v **The U.S. Transportation Sector:**

- λ **Is 95% dependent on petroleum;**
- λ **Accounts for 67% of all U.S. petroleum use;**
- λ **Produces a significant share of U.S. pollutant releases;**
- λ **Has major impacts on consumers, the economy, and the national trade balance;**
- λ **Currently has no readily available alternative to petroleum; and**
- λ **Has limited infrastructure to support alternative fuels.**

Alternative Transportation Fuels



- ∨ **Electricity**
- ∨ **Ethanol**
- ∨ **Hydrogen**
- ∨ **Methanol**
- ∨ **Natural Gas**
 - λ **Compressed**
 - λ **Liquefied**
- ∨ **Propane**
- ∨ **100% Biodiesel**
- ∨ **P-Series**

Alternative Fuel Vehicles Available Now



- ✓ **Electric**
- ✓ **Ethanol**
- ✓ **Natural Gas**
- ✓ **Propane**

Electric Vehicles



- ✓ **Low Emissions**
- ✓ **Quiet**
- ✓ **At least 4% of new vehicles sold in California starting in 2003 must be EVs**
- ✓ **Expensive**
- ✓ **Limited Range**

Ford Ranger



Toyota RAV4



Ethanol Vehicles



- ✓ **Low GHGs**
- ✓ **Less Reactive**
- ✓ **Subsidy Required to be Cost Competitive**
- ✓ **Few Refueling Stations but Numbers Increasing**

Ford Taurus



Ford Ranger



Chrysler Minivan





Ford Crown Victoria

Natural Gas Vehicles



Ford F-150



- ✓ **Very Low Emissions**
- ✓ **Good Performance**
- ✓ **Lower Cost Fuel**

- ✓ **Limited Range, but Adequate for Most Applications**
- ✓ **Few Refueling Stations**
- ✓ **Higher Cost Vehicle**

Honda Civic



New Flyer D40 LF Bus



Propane Vehicles



- ✓ **Low Emissions**
- ✓ **Good Performance**
- ✓ **Cost Similar to Gasoline**

- ✓ **Few Typical Refueling Stations, Many Potential Places to Refuel**
- ✓ **Higher Vehicle Cost**

Ford F-150



Ford Club Wagon



Alternative Fuel Vehicle R&D Challenges



- ✧ **EV Batteries**
- ✧ **Ethanol Production from Cellulose**
- ✧ **Reduce Natural Gas and Propane Vehicle Cost**
- ✧ **Expand Refueling Infrastructure**
- ✧ **Hydrogen Production (for Fuel Cell Vehicles)**

Potential Future AFV Technology



- ✓ **Hydrogen Fuel Cell Vehicles**
- ✓ **Direct Methanol Fuel Cell Vehicles**
- ✓ **High Efficiency Direct Injection Engines for Light- and Heavy-Duty Vehicles**

Fuel Cell Ford Focus



Fuel Cell Mercedes A-Class



Hybrid Passenger Cars



- ✦ **DOE programs have spurred interest in hybrid vehicle technologies**
- ✦ **Two models currently available**
 - λ **Toyota Prius (48 mpg)**
 - λ **Honda Insight (64 mpg)**
- ✦ **Potential for very low emissions**
- ✦ **Represent a “Spin-Off” of technology developed for EVs**
- ✦ **Good potential for petroleum conservation**

Toyota Prius



Honda Insight



Vision for Transportation Deployment Programs



- ✓ **A sustainable alternative fuel infrastructure**
- ✓ **Widespread availability of AFV and ATV products**
- ✓ **True acceptance of diverse fuels and technologies in national/regional/local transportation portfolios**
- ✓ **Cost-competitive technologies and fuels in a variety of markets**
- ✓ **A diverse fuel supply for transportation**
- ✓ **A change in societal norms leading to demand for clean and efficient vehicles**

Long-term Outcomes



- ✓ **Billions of gallons of oil displaced or reduced**
- ✓ **Thousands of tons of emission reductions**
- ✓ **Tens of millions of AFVs and ATVs**
- ✓ **Enhanced energy security and improved transportation sustainability**

Deployment Strategies



- ✓ **Understand the market**
- ✓ **Develop and provide unbiased information**
- ✓ **Offer technical and financial assistance**
- ✓ **Develop, issue, and enforce regulations**
- ✓ **Find and support partners**
- ✓ **Conduct mission advocacy**

OTT Deployment Portfolio



- ✓ **Clean Cities**: A voluntary Federal program designed to accelerate and expand the use of alternative fuel vehicles in communities across the country
- ✓ **Testing and Evaluation**: In partnership with industry, validate the performance and emissions of near market-ready advanced technology vehicles
- ✓ **EPACT Replacement Fuels**: To implement the requirements of EPACT, collect data, perform analysis, prepare reports to Congress, and prepare, issue, and enforce needed regulations
- ✓ **Advanced Vehicle Competitions**: Student competitions, such as the Future Truck Challenge and the Ethanol Challenge, provide an unparalleled education in automotive engineering and push the envelope of advanced vehicle technologies

Clean Cities Program Accomplishments



79 Designations

λ **2 new in 2000**

» **Baton Rouge**

» **Truckee Meadows**

λ **3 Designations Scheduled in 2001**

» **Triangle, NC (March 19)**

» **Twin Cities, MN (April)**

» **Vermont (June)**

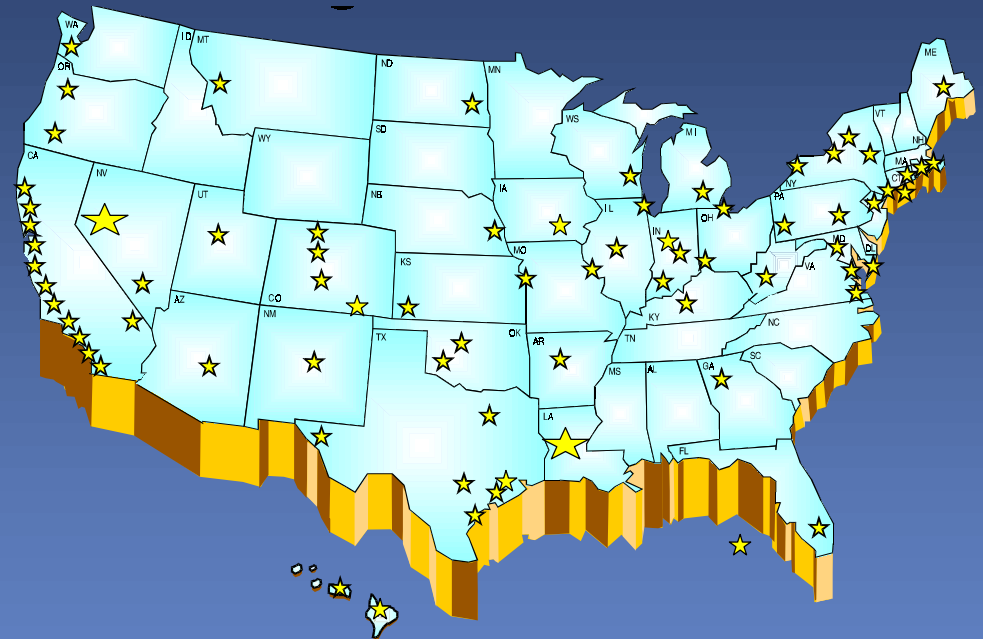
√ **More than 4,400 stakeholders**

√ **115,000 AFVs**

√ **More than 5,000 refueling stations**

√ **102 million gallons of petroleum displaced per year**

√ **19,000 metric tons of emissions reduced per year**



Evolution of Deployment Activities



Reducing

- ✦ **AFV emissions testing**
- ✦ **AFV case studies**
- ✦ **Light-duty fleets**
- ✦ **Analysis of AFV options**
- ✦ **Neat fuels only**

Increasing

- ✦ **Hybrid vehicle testing**
- ✦ **Fuel-efficient vehicles**
- ✦ **Niche markets**
- ✦ **Analysis of future fuels**
- ✦ **Blended fuels**

Selected Transportation Deployment Policies



Policy	Year	Regulations & Standards	Financial Incentives	Information
EPCA (CAFE)	1975	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>
AMFA	1988	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>
EPACT	1992	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
ISTEA & TEA-21	1991 & 1996		<input checked="" type="checkbox"/>	

The Energy Policy Act



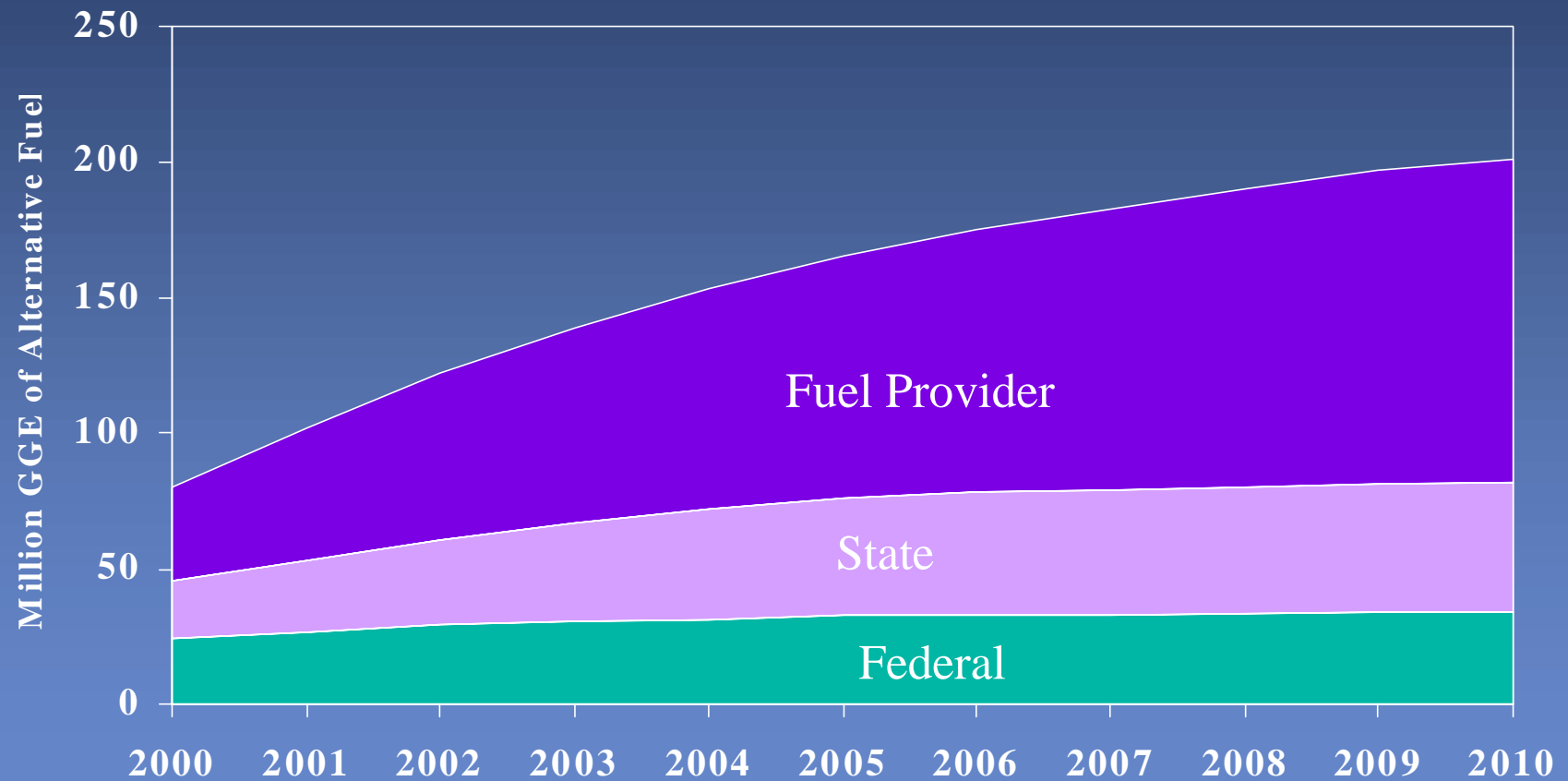
- ✓ **Set a goal – 10% by 2000 and 30% by 2010**
- ✓ **Voluntary programs**
- ✓ **Public Information**
- ✓ **Fleet mandates**
- ✓ **Grants and incentives**

Assumptions in 1992 EPACT



- ✓ **Barriers to alternative fuels are primarily informational**
- ✓ **The vehicle mandates solves the chicken/egg problem**
- ✓ **Fleets are uniform, centrally refueled, and easily regulated**
- ✓ **Small tax incentives and grants are sufficient to push the market**
- ✓ **Fuel providers will be the leaders in AFV use**
- ✓ **Saying we have a goal is all that's needed**

Results Heading In Right Direction



Other Parts of EPACT Working Too

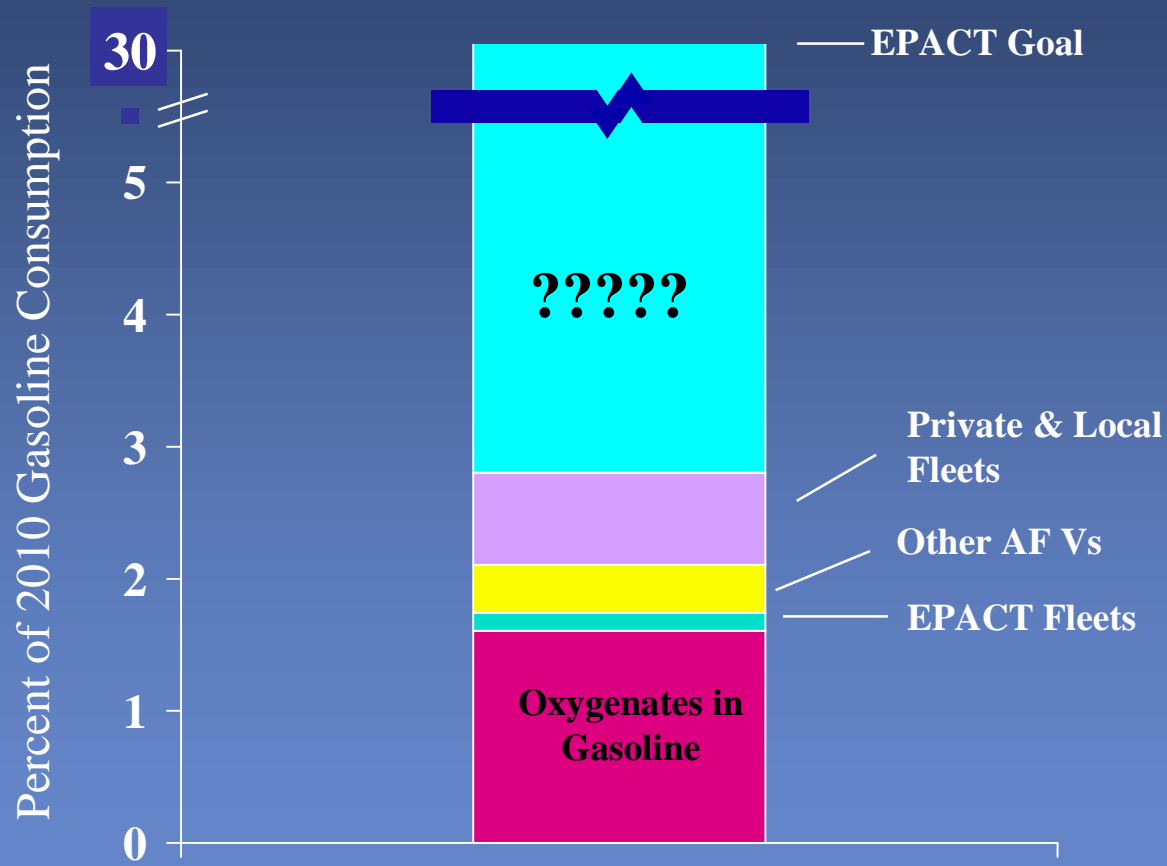


- ✓ **Clean Cities has 80 participants - thousands of vehicles**
- ✓ **Public information on AFVs widely available**
- ✓ **Refueling stations have grown**
- ✓ **Dozens of AFVs offered by OEMs**
- ✓ **U.S. AFVS among the best in the world**

But not good enough to meet the EPACT 30% goal for 2010



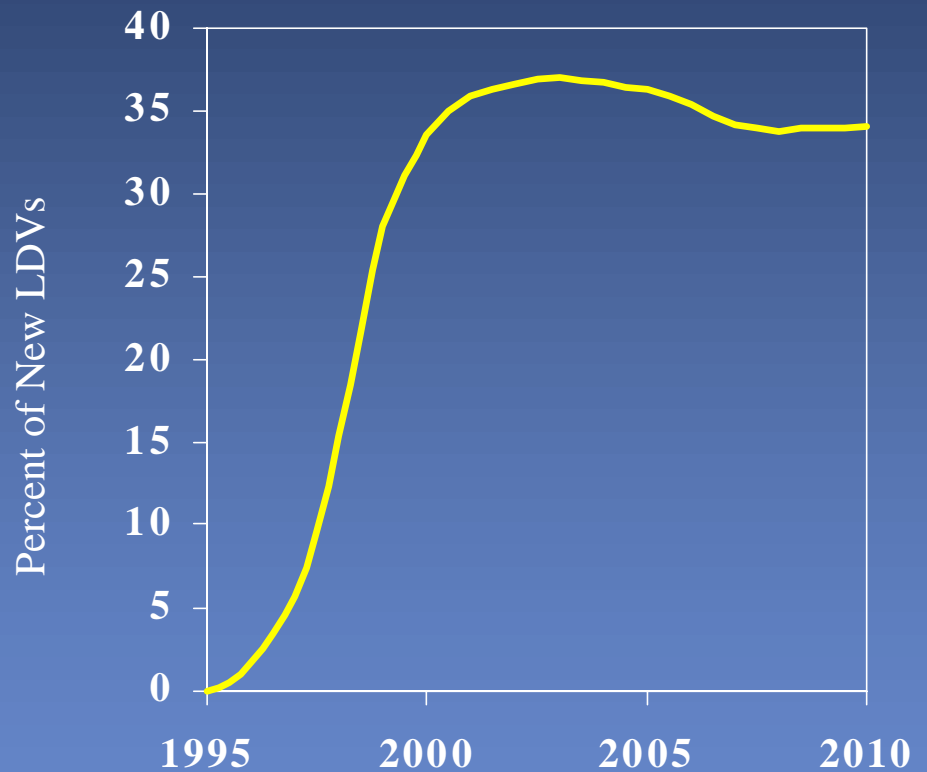
- v 30% is about 30-40 Billion gallons
- v Oxygenates in gasoline are predicted to continue
- v Existing EPACT fleets and other AFVs contribute about 0.4%
- v Including Private & Local Fleets in EPACT could add at most 0.7% by 2010



What Had to Have Happened to Meet EPACT Goals



- v To meet the EPACT goals would have required:
 - λ about 6% of all LDVs in 2000 to be AFVs
 - λ about 35% of all new LDVs in 2000 and beyond to be AFVs



Federal Promotion of Clean and Efficient Vehicles



- √ **Recognition of important Federal role**
 - λ Regulation may be necessary
 - λ Incentives may be necessary
 - λ Consumer education will be necessary
- √ **Comprehensive program**
 - λ Multiple market segments
 - λ Multiple technology options
- √ **Coordination and partnership**
- √ **Long term commitment**

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Resources at the Department of Energy



✓ **Clean Cities**

- λ **1-800-CCITIES**
- λ **<http://www.cities.doe.gov>**

✓ **Alternative Fuels Data Center**

- λ **Alternative Fuels Hotline 1-800-423-1363**
- λ **<http://www.afdc.doe.gov>**

✓ **Fuel Economy Guide**

- λ **<http://www.fueleconomy.gov>**

✓ **EV and Hybrid Test Data**

- λ **http://www.ott.doe.gov/otu/field_ops**
- λ **<http://www.ott.doe.gov/hev>**