
Low Carbon Fuel & Vehicle Pathways

Sarah Dunham, Director
Transportation and Climate Division
March 28, 2007

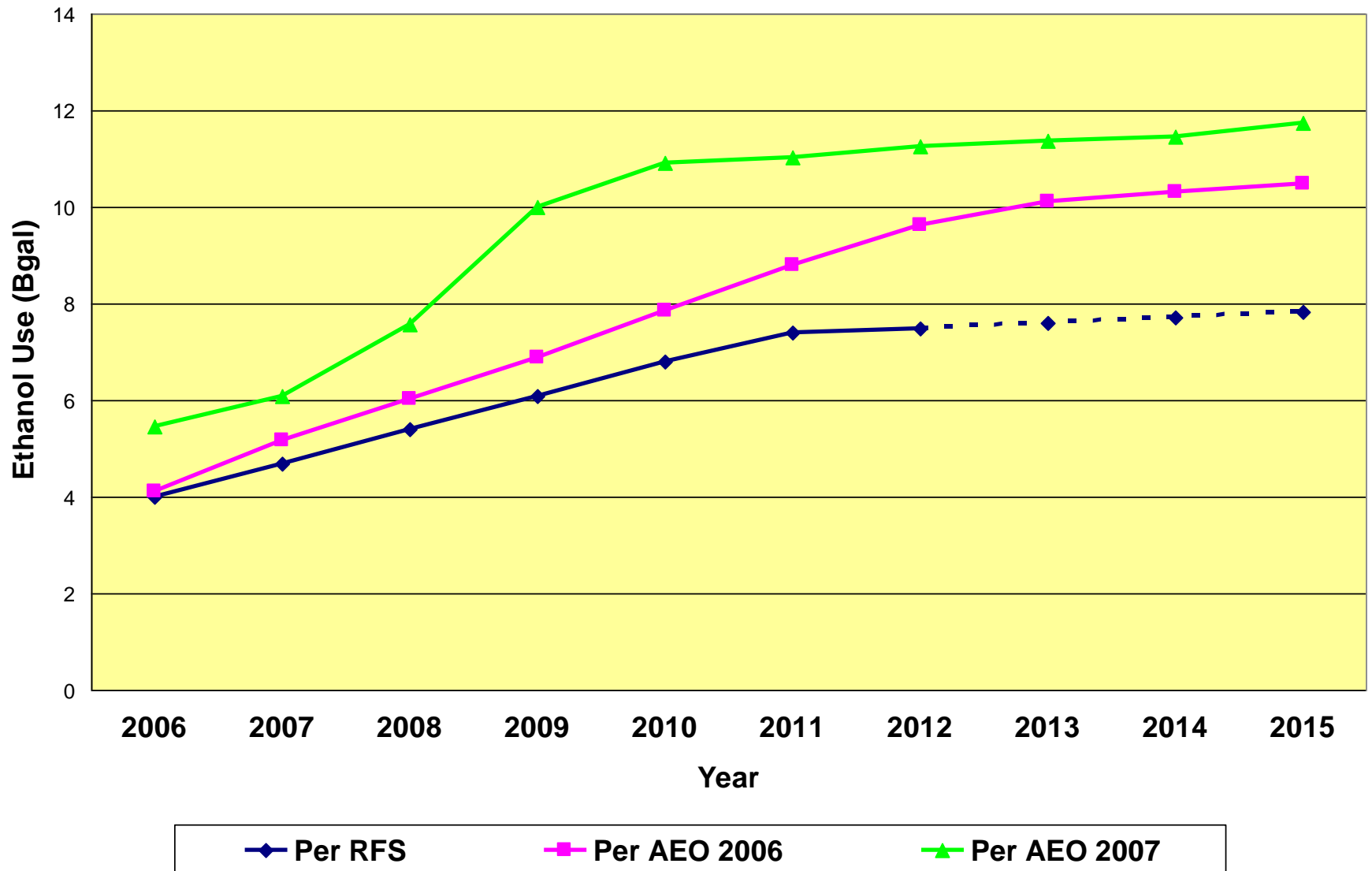
OTAQ's Climate Efforts

- Conducting inventories, modeling, and technical analysis
- Development of new technologies
 - Hydraulic hybrids
 - Clean diesel combustion technologies
- Renewable Fuels
 - Implementing the RFS & analyzing impacts of increased renewable fuel use
 - Preparing for the AFS
 - Certification/ emissions/ fuel quality
 - Expanding lifecycle analytical efforts
- Voluntary Efforts
 - SmartWay Transport Partnership, Best Workplaces for Commuters
- Consumer Information
 - Fuel economy labels and annual trends report
 - On-line Green Vehicle Guide

Recent Developments

- Renewable Fuels Standard (RFS) to be finalized soon
- President's 2007 State of the Union
 - Alternative Fuel Standard proposal (35 billion gallons of renewable and alternative fuels by 2017)
- California & the EU each announce a 'Low Carbon Fuel Standard'
- Automakers recently testified before Congress on climate policy
 - Last year, they committed to produce 50% of their vehicles as FFVs by 2012 (if fuel infrastructure is in place)
- Increasing interest in FFVs, plug-ins, and other advanced technologies
- 110th Congress— New bills on energy security & climate change
 - Including increased renewable fuels requirements, FFV production mandates, fueling station mandates, manufacturing and consumer tax incentives, etc

Increasing Ethanol Projections



Renewable Fuel Standard

- The Energy Policy Act of 2005 required EPA to promulgate regulations that ensure a specified amount of renewable fuel used in the U.S. transportation sector
 - 2006: 4.0 billion gallons/yr
 - 2007: 4.7
 - 2008: 5.4
 - 2009: 6.1
 - 2010: 6.8
 - 2011: 7.4
 - 2012: 7.5
 - 2013+: Same percent of renewables for 2012 (250 million gallons of which must be cellulosic ethanol)
- Timeline
 - NPRM published September 26
 - Close of public comment November 12
 - Final rule expected spring 2007



Potentially Qualifying Renewable Fuels

- Ethanol
 - Corn
 - Other Starches
 - Cellulose
 - Sugar
- Biodiesel (ester) and Renewable Diesel
 - Veg Oils and Animal Fats
- Biocrude
 - Veg Oils and Animal Fats
- ETBE (if used)
- Bibutanol
- Fischer-Tropsch-diesel/gasoline, MTBE (if used), Methanol
 - Biogas
 - Biomass gasification
 - Sewage plant
- Others



Lifecycle GHG Differs Across Renewable Fuels

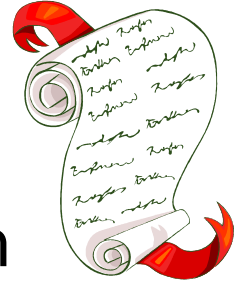
- Compared to an energy equivalent amount of gasoline or diesel fuel replaced
 - Ethanol from corn kernels: 22 % lower GHG
 - Ethanol from cellulose: 91 % lower GHG
 - Ethanol from sugar cane: 56 % lower GHG
 - Biodiesel from soy: 60 % lower GHG
 - Biodiesel from waste grease: 76 % lower GHG

Energy and CO₂*

- Petroleum consumption in the transportation sector will be reduced 1.0 - 1.6 %
 - Equivalent to 2.3 - 3.9 billion gal petroleum in 2012
 - ~95% of the reduction is estimated to be from imports
- Transportation sector greenhouse gases (CO₂ equivalent) will be reduced by 0.4 - 0.6 %
 - Equivalent to 9 - 14 million tons in 2012

* Incremental Impacts in 2012 compared to 2004 reference case (results are from NPRM for RFS)

Proposed Alternative Fuel Standard



- AFS draft legislation sent to Congress on March 19th, 2007
- Intended to implement the President's SOU commitment to reduce petroleum-based gasoline consumption 15% by 2017 through renewable and alternative fuels
- 15% reduction in 2017 translates into a target of 35 billion gallons of renewable & alternative fuel use in transportation system

AFS— Major Provisions

- Builds on current RFS structure
- Requires annual volume targets, increasing to 35 billion gallons in 2017
- Combines the existing definition of the RFS (plant and animal-based fuels plus certain other fuels like biodiesel) with a modified version of the existing EPCRA definition of “alternative fuels”
- Specifically adds natural gas, liquid fuels from domestic natural gas, liquefied petroleum gas, hydrogen, coal-derived liquid fuels, electricity and other fuels to be determined by DOE.
- Compliance values are based on the measurement of the BTU content of various alternative fuels relative to ethanol.

Available Fuel Sources

- Already, ethanol production is expected to outpace the RFS requirements
 - EIA's Annual Energy Outlook for 2007 projects 11.2 billion gallons ethanol by 2012
- Domestic corn ethanol will continue to be the most significant source of renewable fuel
 - Estimated to be 15B gallons maximum by National Corn Growers Association
- Optimistic that cellulosic ethanol will begin to contribute to the market over the next decade
- Biodiesel will also continue to grow
- Other alternatives (e.g. CNG, CTL, etc.)



Fueling Infrastructure

- Current ethanol fuels are blends of gasoline and ethanol - E10 and E85
- E10 nationwide would use about 15B gallons
- E85 would have to expand significantly for ethanol volumes much higher than 15 billion gallons
 - Will need to significantly expand the number of pumps from today's 1,100
 - Will need to increase number of flex fuel vehicles from today's 6 million

Potential Fuel Blends

- E85 may not be our only option
- Blends above E10 other than E85 are being discussed for use
 - Minnesota passed law mandating E20, pending federal approval
- Testing of blends by EPA required to ensure
 - Quality of fuel maintained
 - Emission standards are met
- Use of other blend ratios in FFV's are possible

Other Recent Renewable Fuels Work

- Launch of the *SmartWay Grow & Go* program
 - Promotes the environmental benefits of renewable fuels and encourages SmartWay companies to use (and sell) these fuels
- Expanding emissions information on E85 and biodiesel blends
- Addressing technical and regulatory barriers
 - Stage II Vapor Recovery
 - FFV fuel economy
- Updated web-based fact sheets on E85 and biodiesel (www.epa.gov/smartway/growandgo)
- Developing more extensive lifecycle analysis capabilities

Future Renewable Fuels Work

- A future with greatly expanded renewable fuel consumption will require:
 - Additional emissions testing
 - Strategies to ensure adverse environmental impacts are minimized or prevented
 - Expanded public outreach efforts
 - Additional research into areas that keep renewable fuels on a sustainable path (harvesting practices, feedstocks, etc)
 - Improved lifecycle methodologies that take into account international impacts
 - Addressing vehicles and fuels as a system

Examples of Fuel & Vehicle System Analysis

Fuel Efficient Vehicle Technology Report

- Published a report on the costs and fuel savings (from a consumer perspective) of new, fuel efficient vehicle technologies
- Evaluated packaged gasoline technologies, advanced diesel engines, gasoline-electric hybrids, and diesel-electric hybrids
- These technologies can improve FE by anywhere from 20-70%
- All technology packages pay back to consumers w/in 14 years
 - www.epa.gov/otaq/technology

E85 vehicle testing

- Ann Arbor lab is testing an “optimized” FFV

Examples of Fuel & Vehicle System Analysis (cont')

Plug-in Hybrid Analysis

- Analyzed the feasibility and possible benefits of plug-in hybrid commercialization
- Organized a “technical forum” call with states in March
 - www.keystone.org/spp/documents/03_15_2007PHEV%20Mui.pdf

“Wedge” analysis

- We recently completed a "wedge analysis" of approaches that can reduce GHG emissions in the U.S. transportation sector
- Included evaluation of system approaches that combine vehicle technologies, low carbon fuels, and TDM approaches
- Provides a metric to evaluate the approaches on a more common basis (cumulative emission reductions over time)