An Environmental Perspective: EPA's RFS Proposal

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Sustainable Biofuels in America's Energy Future

To move beyond oil, America must have a sustainable biofuels plan

- Biofuels as a transportation fuel, rather than an additive
- Sustainable and compatible with the nation's agricultural, forestry and land use needs
- Adverse air and water impacts are mitigated

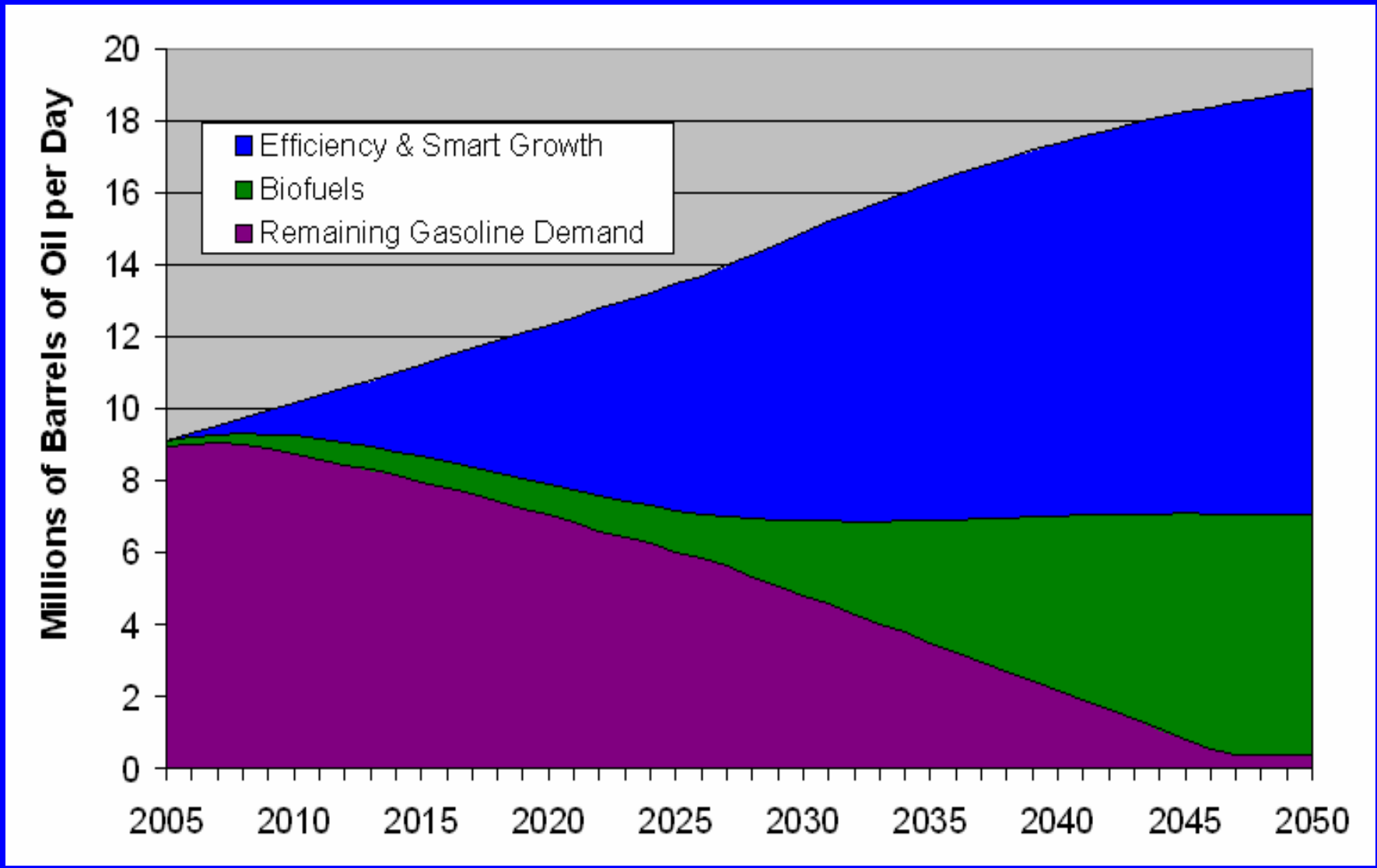
Biofuels Can Be Cost Competitive

- Biofuels need to reach a price where they don't need subsidies to become more than a fuel additive
- Advanced cellulosic ethanol should be able to compete even without today's high prices

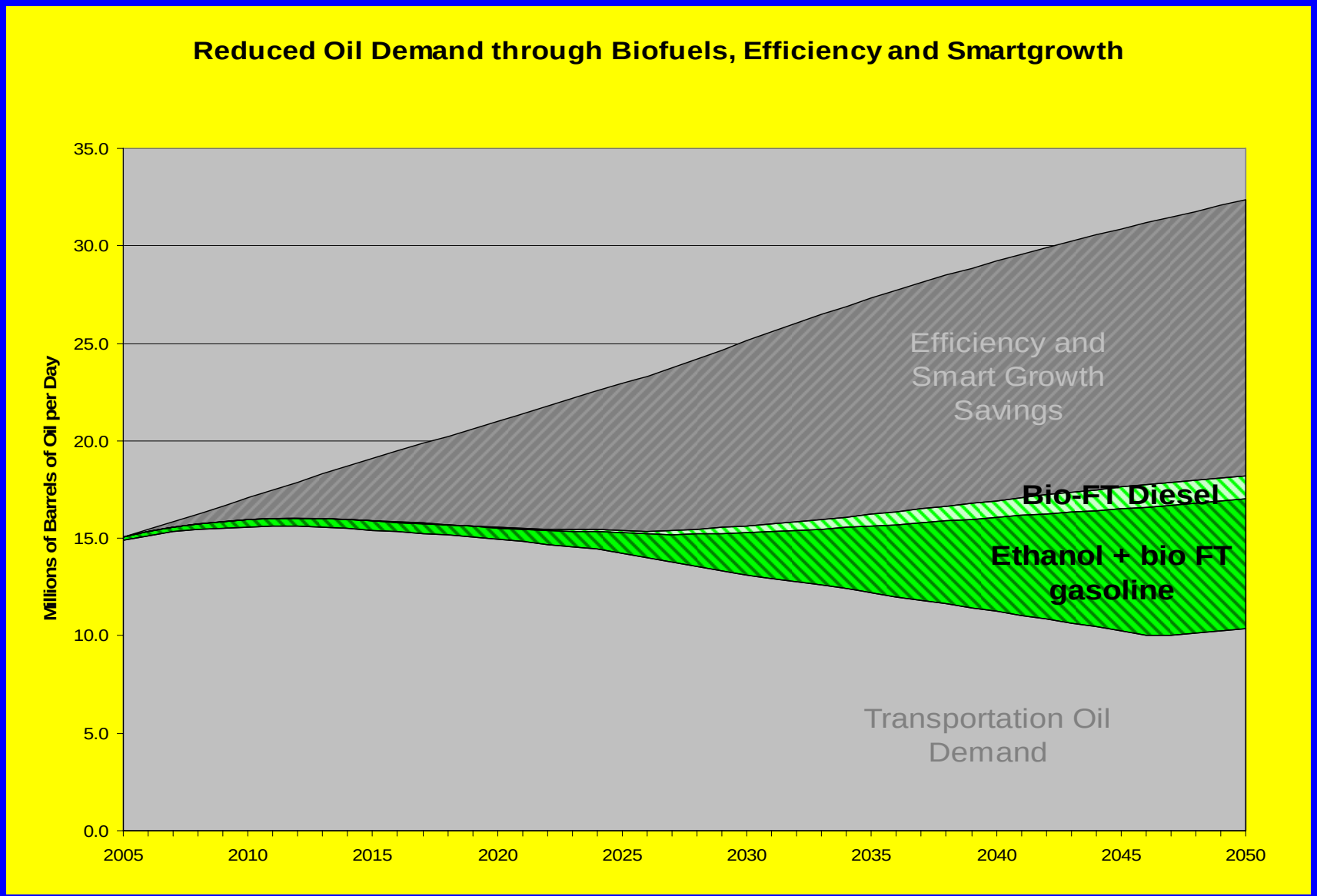
Wholesale Price ($ per Gal Gasoline Equivalent)		High	Average	Low
Advanced Cellulosic Ethanol (depending on technology and scale)		$0.91	$0.77	$0.59
Gasoline	2000-2004	$1.50	$0.91	$0.44
	2025 - EIA Forecast	$1.03	$0.79	$0.48

Source: NRDC, et al,: *Growing Energy*, 2004

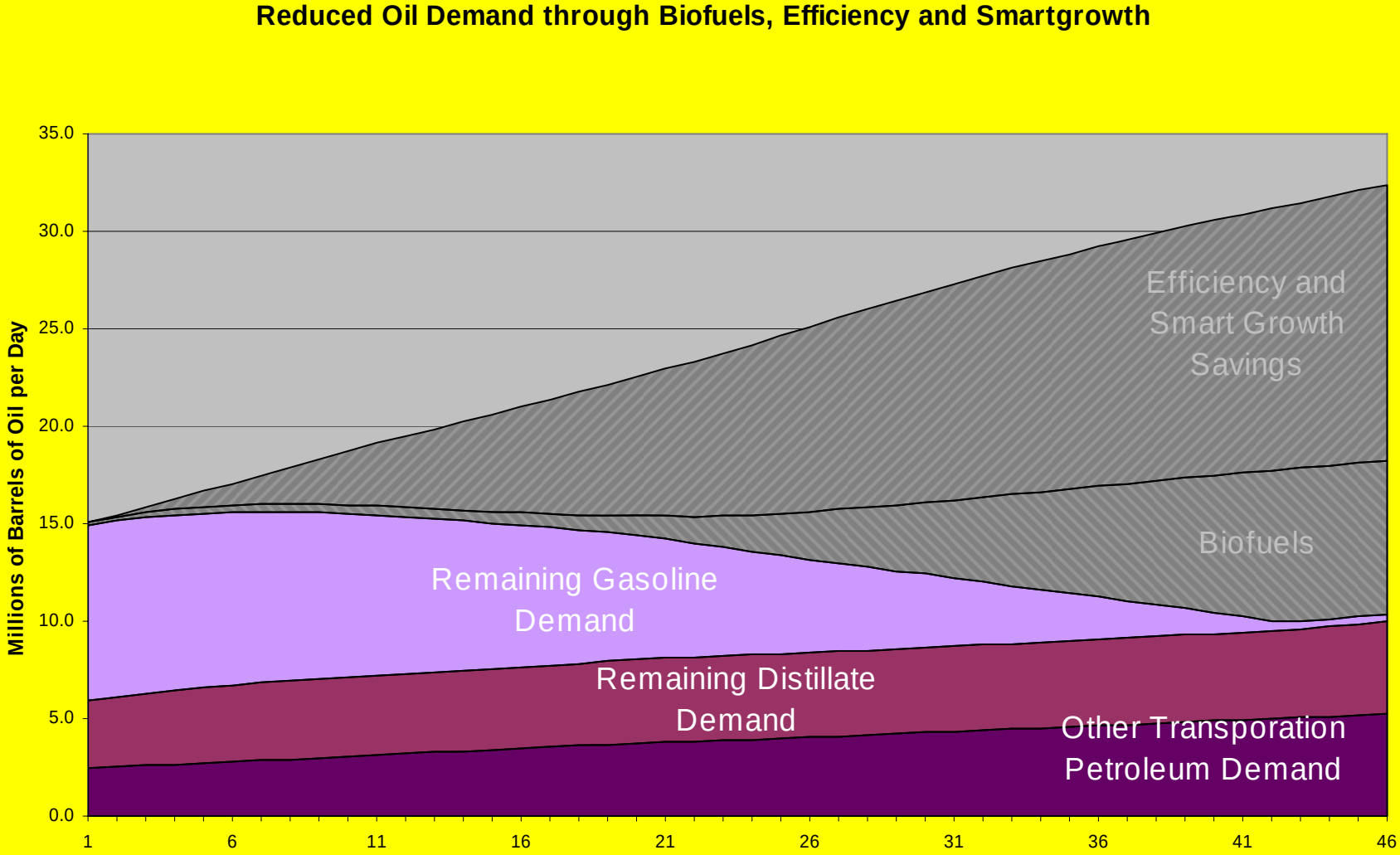
Biofuels + Efficiency = No Gasoline Demand in 2050?



Most of the Biofuels Will Replace Gasoline



Demand Reductions Will Be Driven By Gasoline, Not Diesel



What Would 100 Billion Gallons/Year of Biofuels Mean?

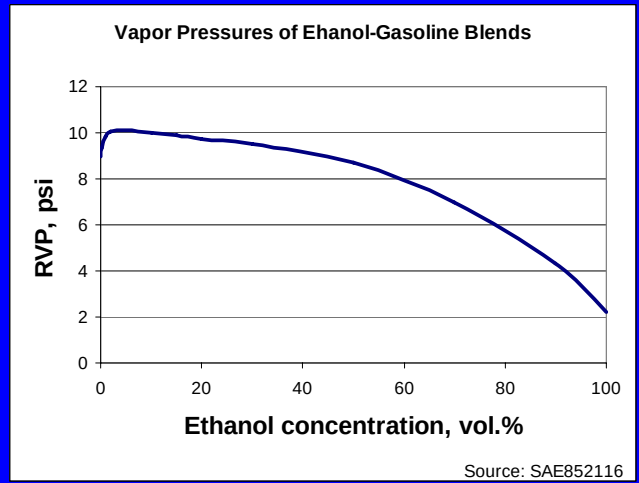
- Without efficiency improvements: 36% of an unsustainable gasoline demand
- With achievable efficiency improvements, 94% of our remaining demand
  - Efficiency improvements are the key to sustainable biofuels production, given potential land constraints
- ***We need to do for biofuels in the 21st century what we did for food production in the 20th century***

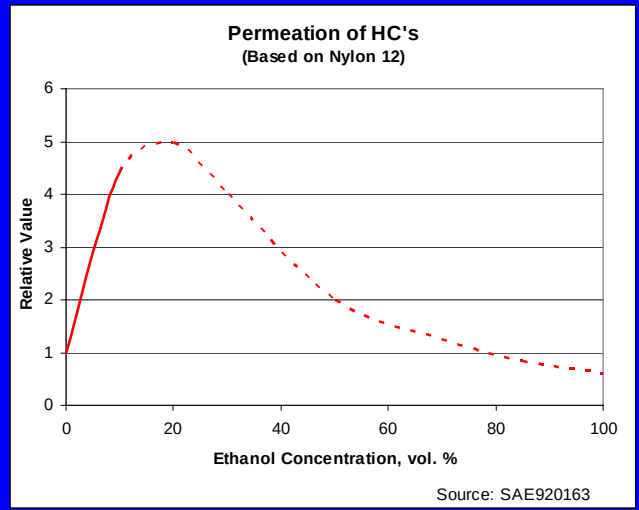
With Efficiency Improvements, Land Is Not A Constraint to Biofuels Growth

	Gasoline Demand (B. Gal. Gas-eq.)	*Switchgrass Yield (dt/acre/year)*	*Conversion Efficiency (Gal. Gas-eq/dt)*	*Land Needed (Mill. Acres)*
Status Quo 2050	289	5	33	1753
Production and Efficiency Gains				
Smart Growth/Efficiency	108	5	33	657
Conversion Efficiency	108	5	69	313
Biofuels Coproduction	108	5	77	282
Switchgrass Yield	108	12.4	77	114
Alternative Sources of Land and Biomass				
Protein Recovery	Replace 50-100% of 73 million acres of soybean			41 - 77
Corn Stover	Collect 75% of 323 million tons of corn stover			21 - 58
CRP Land	Convert 33-50% of CRP acreage into switchgrass			6 - 48

Air Quality Impacts of Low-Blend Ethanol Must Be Addressed

- EPA and CARB models show low-blends increase VOC and NOx and decrease CO emissions
  - Up to 6% VOC + NOx increase locally
  - Especially significant in CA and w/ nonroad S-I engines
- Impacts of low-blends are only likely to become bigger as we understand permeation



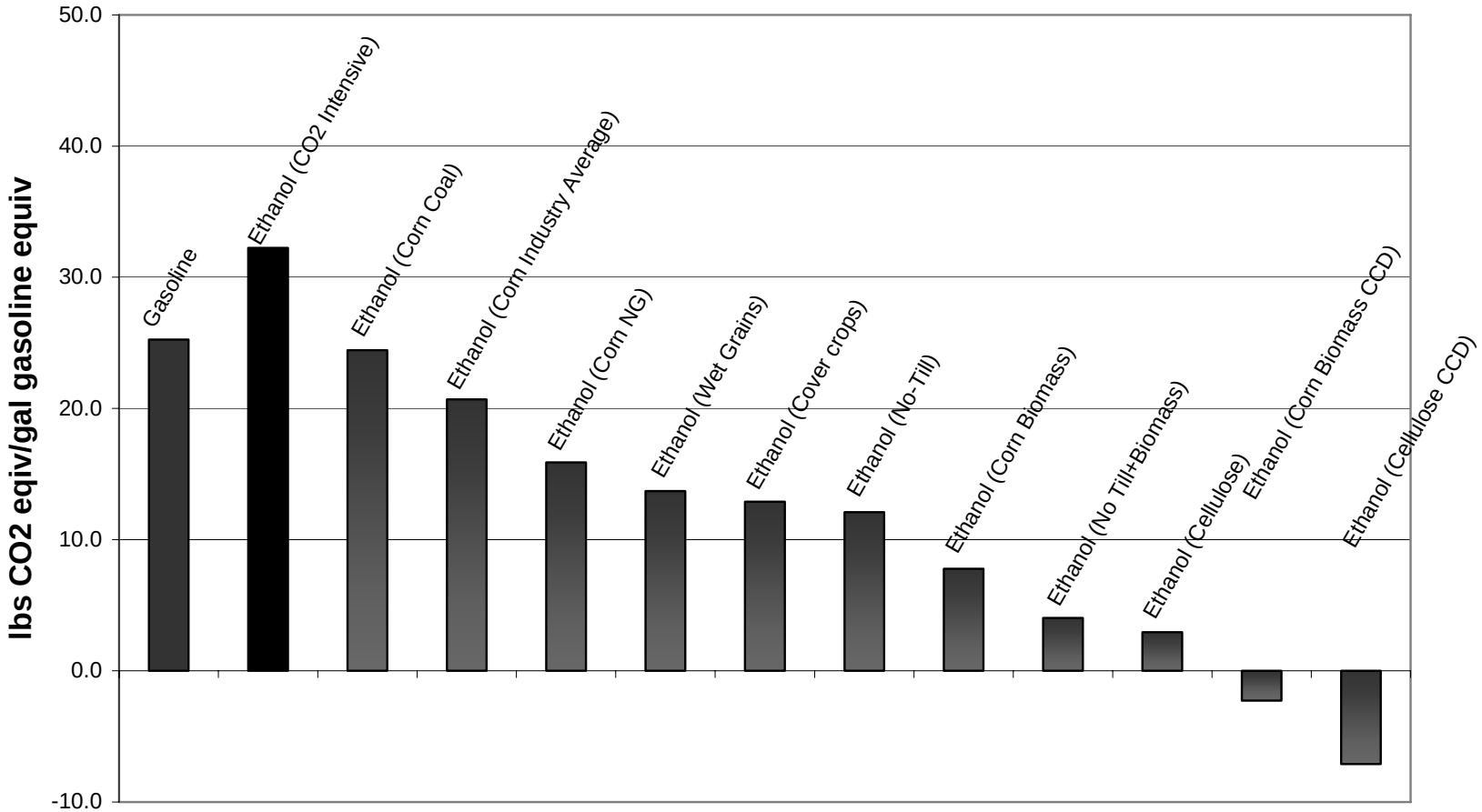


No "Show-Stoppers," But Other Unresolved Issues Must Be Addressed

- Many unresolved questions to consider:
  - Commingling of blended fuels (E10-E85)?
  - Toxics: If benzene decreases, but aldehydes increase, is that a good trade-off?
  - Will NOx increases from low-blends increase PM2.5? Create new climate change concerns?
  - What are the aggregate and other public health impacts?
  - What can be done to the fuel and/or vehicles to reduce environmental and health impacts?

Many Different Ethanol Pathways

Greenhouse Gas Emissions from Different Ethanol Production Practices



…And More Paths Opening

- New technologies
  - Biobutanol, thermochemical processing (gasification), algae feedstocks, and other R & D areas attracting new attention
    - Potential for 15,000 to 200,000 gallons per acre
    - Some could use existing pipeline infrastructure
- To avoid future competition for feedstock, water, land and other impacts, new technologies must provide greater benefits/gallon and more gallons/acre

How To Ensure Sustainable Biofuels Future?

- RFS should set environmental performance standards, including oil displacement/GHG standards
  - Minimum performance standards (e.g., 20% better than gasoline)
  - Market structures that encourage competition based on performance (e.g., RFS credits based on lifecycle GHG emissions)
  - Flexible enough to allow new technologies, fuels, production methods to compete
- Bottom Line: RFS should commit to using more renewable fuels, set performance standards, and shouldn't pick winners prematurely

The Transition Presents the Greatest Challenges

- Transition impacts from production:
  - Impacts on soil, water, habitat, and potentially food from too much use of starch, sugar, vegetable oil based biofuels
- Transition impacts from end-use:
  - Ozone impacts of low blends of ethanol and gasoline
- Need to be managed, but will be helped by performance standards, rapid deployment of advanced technologies, and early use of biofuels as an alternative instead of as an additive

Conclusions: Recommendations For The RFS Proposal

- **EPA RFS should include performance standards for biofuels**
  - e.g.: Ratios should be set according to lifecycle oil displacement and GHG emission reductions
- **EPA RFS should include incentives for more sustainable biofuels production into its registration system**
  - e.g.: The RIN system should include placeholders so it can evolve into a tracking system for multiple environmental characteristics
- **EPA should design its RFS program for projected biofuels production, rather than EPAct mandates.**
  - e.g.: EPAct's 250M g/yr of cellulosic ethanol should be surpassed by 2013, and could reach 1 billion g/yr by 2016