

Iowa Renewable Fuels Association Renewable Fuels Summit

High Octane Panel Discussion
January 31, 2017

Gary Herwick – Transportation Fuels Consulting, Inc.

Work for Ethanol Industry

Completed

Study of Ethanol Blend Fuels (2013 –15)

- Major value of ethanol is octane
- E10 saves consumers 6 cents / gallon
- E85 cost 38 cents per gallon = RIN price
- High octane mid-level blends could save consumers 16 cents per gallon

Current Activities

Ethanol Value Model (EVM)

- Massive price database
- Real world E85 sales data

Costs and Benefits Using OMEGA

- Not an endorsement of OMEGA
- Answers what EPA would conclude

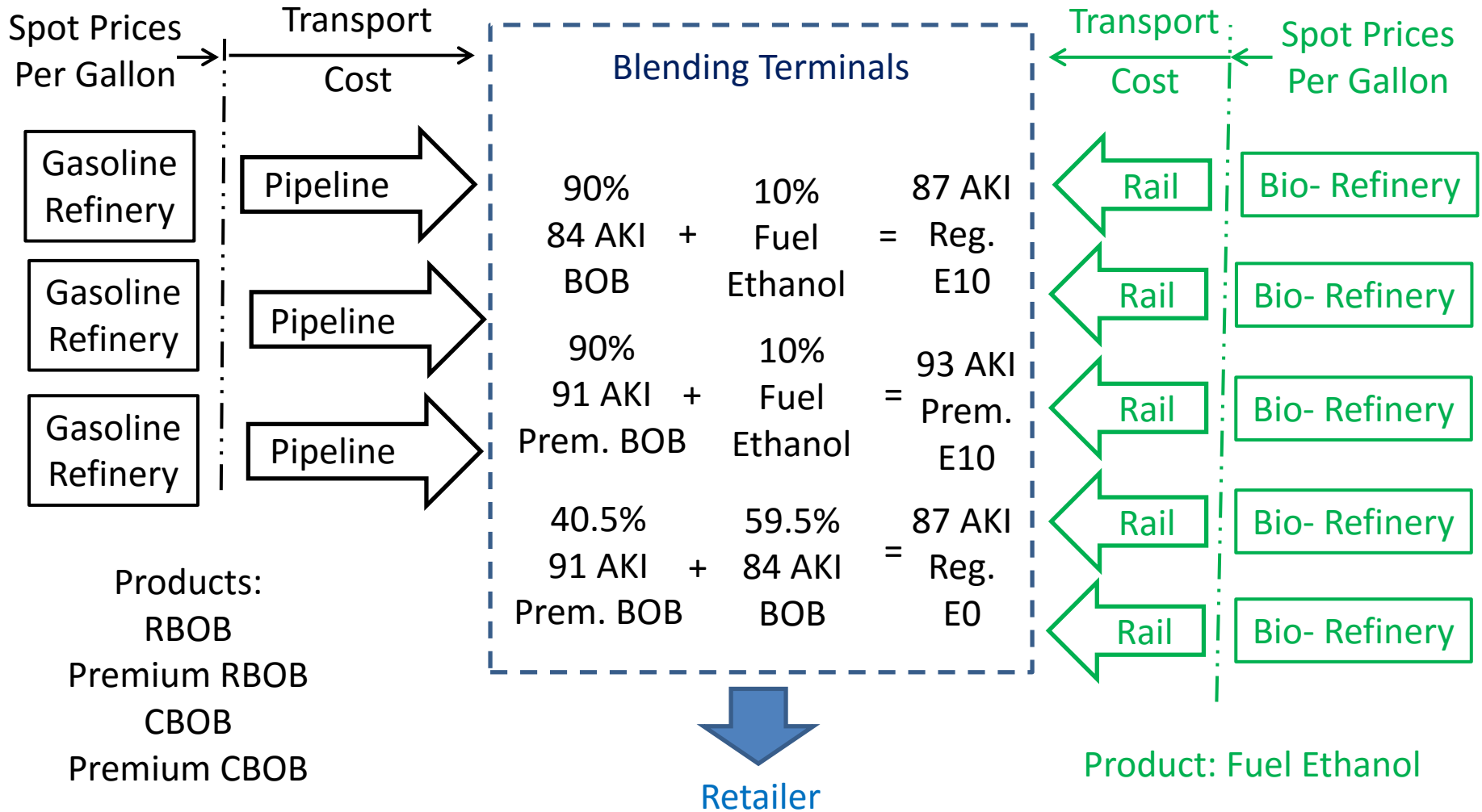
Tests at Oak Ridge National Laboratory

Defour Group – Dean Drake

Air Improvement Resource – Tom Darlington

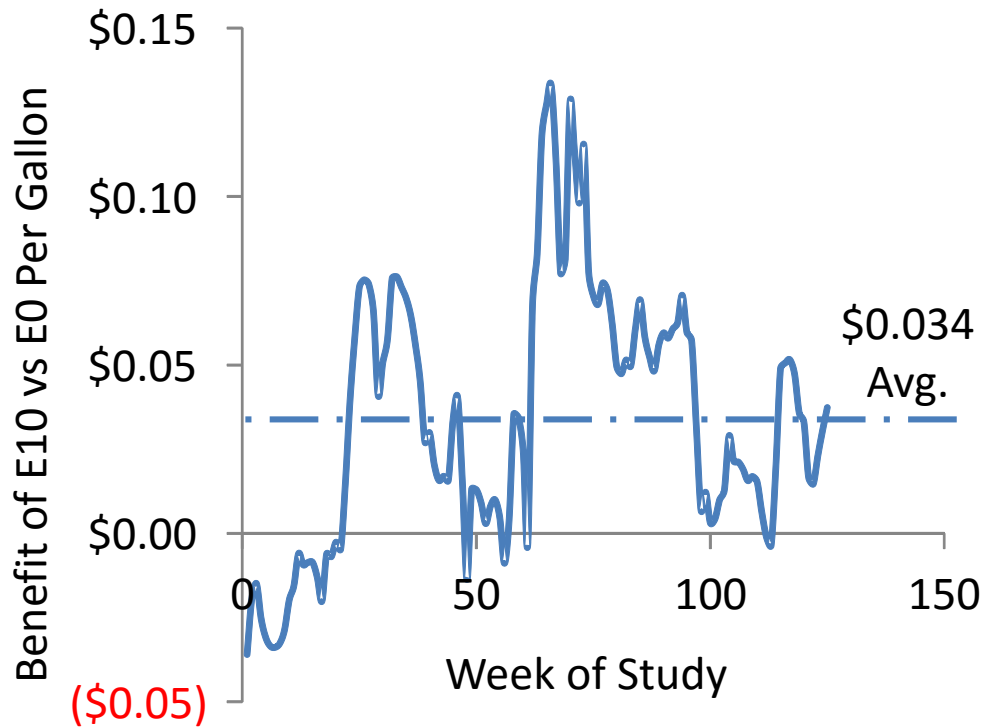
Transportation Fuels Consulting – Gary Herwick

Most Studies Ignore How Fuel Is Produced Today



Value of Ethanol in E10 = Price Per Gallon of 87 AKI E0 – Energy Equivalent Price of 87 AKI E10

Preliminary Results (through 14NOV16)



Does E10 Cost More or Less Than E0?

Average Savings Due to Ethanol in Regular Gasoline is \$0.034 Per Gallon of E10 Sold

Translates to \$4.4 Billion Annual Savings

Only Consistent Period of Loss Was When Oil Prices Were the Highest

E10: The Untold Success Story

Transformed Motor Fuel

Traditional Gasoline

- 100% petroleum
- Produced at refinery
- Sold directly as a motor fuel

E10 Replaced Traditional Gasoline

- Oil refineries make sub-octane blend stock
- Bio-refineries make fuel ethanol
- Two combined at blending terminals
- Today, consumer “gasoline” is a 10% ethanol blend

Estimates of Costs Vary Widely

Manhattan Institute in 2015:

“In 2013, ... U.S. consumers were forced to pay \$10.6 billion more than they would have, had they purchased gasoline alone.”

Congressional Budget Office in 2014

“prices for ... E10 ... would probably be essentially the same in 2017 whether the RFS requirements were kept at the amounts proposed for 2014 or the RFS was repealed.”

Defour Group in 2014:

“Overall, consumers saved \$7.4 billion in 2013 because of our nation’s biofuels policy”

Results

Impact of HCR/HOLCF on MYR2025 Vehicles

Item	Without Strategy	With Strategy
Sales	16,419,435	16,419,435
Total Cost	23.4 billion	16.4 billion
Avg vehicle cost	\$1,425	\$894

ORNL/NCGA Cadillac ATS 2.0L Turbocharged, 10.5:1 CR*

DRAFT Project Report

September 13, 2016

Table 2. Summary of E0-equivalent fuel economy gains from downspeeding and downspeeding/downsizing experiments with Cadillac ATS vehicle

Drive Cycle	Downsped ATS (Compared to ATS in factory setup with E10 fuel)		Downsped/Downsized SRX SUV (Compared to EPA data for V6 SUV fueled with E0 cert fuel)	
	E10	E25	E10	E25
FTP	+9.0%	+9.2%	+11.3%	+12.8%
HFET	+7.2%	+8.0%	+8.4%	+10.1%
US06	+4.3%	+6.0%	+4.1%	+8.2%

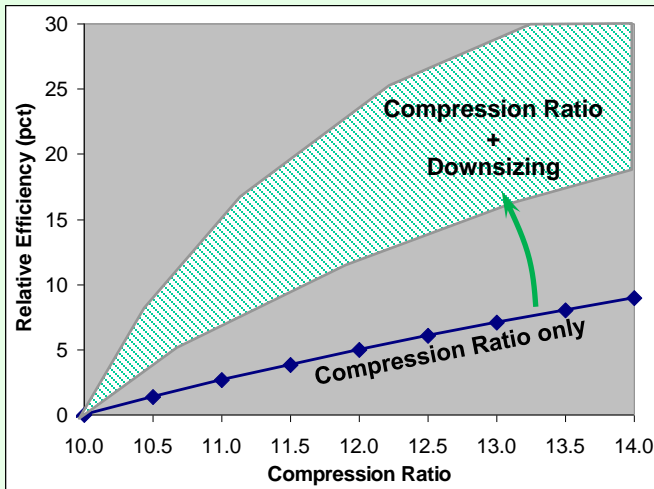
Table 3. Summary of CO₂ reduction from downspeeding and downspeeding/downsizing experiments with Cadillac ATS vehicle

Drive Cycle	Downsped ATS (Compared to ATS in factory setup with E10 fuel)		Downsped/Downsized SRX SUV (Compared to EPA data for V6 SUV fueled with E0 cert fuel)	
	E10	E25	E10	E25
FTP	-5.4%	-6.5%	-11.2%	-13.2%
HFET	-3.7%	-5.4%	-8.8%	-11.1%
US06	-1.1%	-3.7%	-5.0%	-9.6%

*NCGA High Octane Fuel Demonstration at ORNL, Project Status 9-13-2016, attachment to NCGA TAR Comments



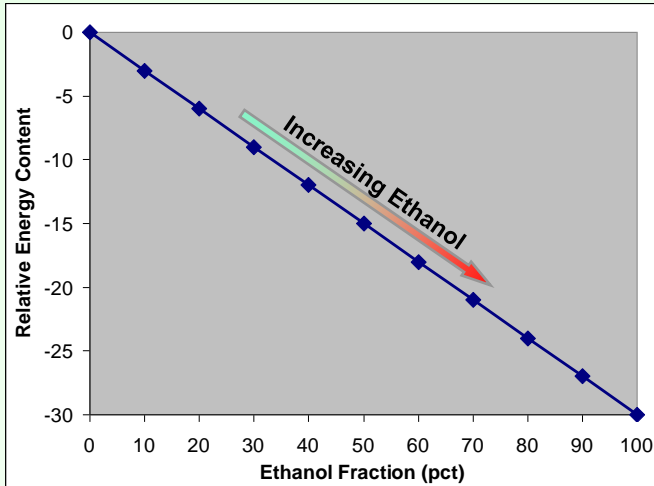
Efficiency Overview (Dr. Andy Randolph)



Engine efficiency increases with increasing compression ratio. Efficiency gains are MUCH greater when compression ratio increases are coupled with downsizing.

$$\eta_{th,ideal} = 1 - \frac{1}{r_c^{\gamma-1}}$$

where,
 η = thermal efficiency
 r_c = compression ratio
 γ = specific heat ratio = C_p/C_v



Fuel energy content decreases with increasing ethanol. Fuel economy improves only if efficiency gains are greater than energy content losses.

