

High Octane Fuel Market Assessment



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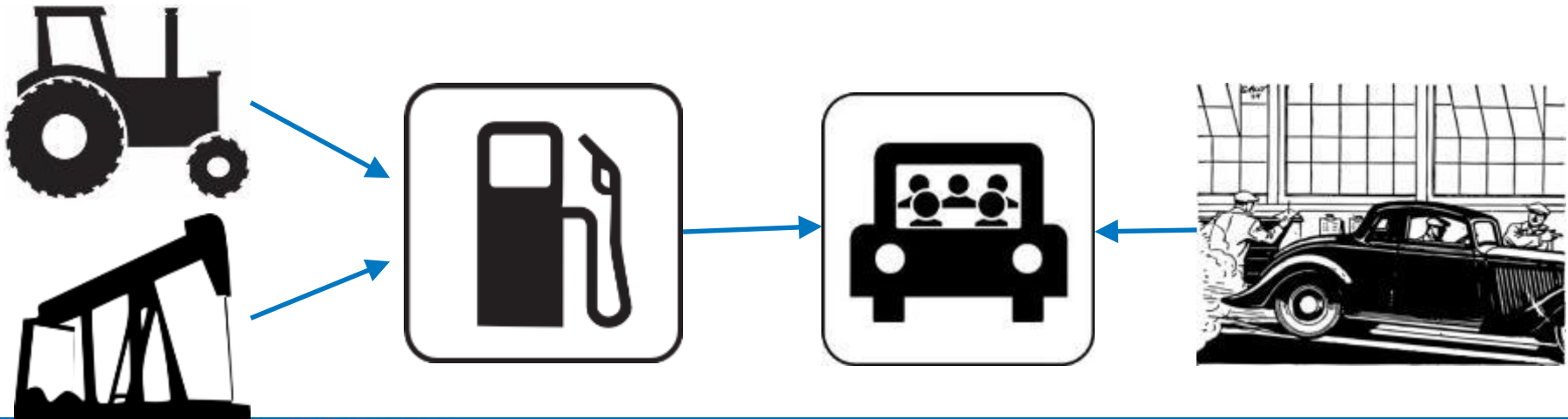
Transportation Market Analyst

High Octane Fuel Market Assessment

Purpose: Assess the feasibility, economics, and logistics of adopting HOF by drivers, vehicle makers, fuel retailers, and fuel producers

Strategy:

1. Identified benefits of High Octane Fuel (HOF) to key participants
2. Defined hurdles to HOF adoption
3. Proposed resolutions to hurdles
4. Grouped compatible/synergistic resolutions into 8 adoption scenarios
5. Modeled vehicle adoption rates for various scenarios
6. Modeled biofuel production and supply chain



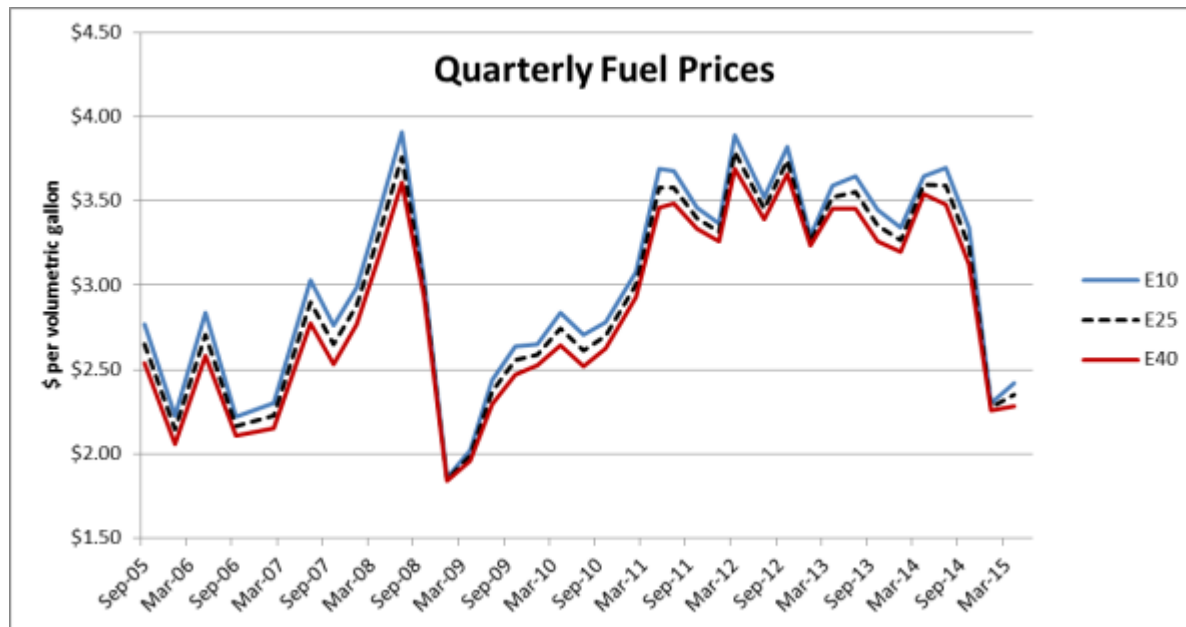
Potential Benefits of HOF Adoption

- **Drivers**

- Fuel cost savings: 8¢/gal (for E25) and 16¢/gal (E40)
 - EIA AEO 2014 projects savings of 18¢/gal (E25) and 36¢/gal (E40) in 2030
- Reduced price volatility
- Increased torque in performance applications
- Energy security and environmental attributes

- **Vehicle manufacturers**

- Greenhouse gas (GHG) reductions
- Increased torque in performance applications



Source: Calculated from Clean Cities Price Reports by proportionally mixing E10 and E74

Potential Benefits of HOF, *continued*

- **Fuel Retailers**

- HOF could fetch higher margins in less price-competitive market
- HOF could differentiate stations in a uniform market
- Cheaper fuel could result in 3% increase in trips to convenience store*

- **Fuel Producers**

- Renewable Fuel Standard compliance
- Economies of scale for cellulosic ethanol
- Enable less expensive blendstocks
- Facilitate additional gasoline export



Source: www.usatoday.com

*Based on elasticity of demand of -0.31 and projected 9% discount in fuel price. Elasticity taken from Havranek, T., Irsova, Z., & Janda, K. (2012). Demand for gasoline is more price-inelastic than commonly thought. *Energy Economics*, 34(1), 201-207.

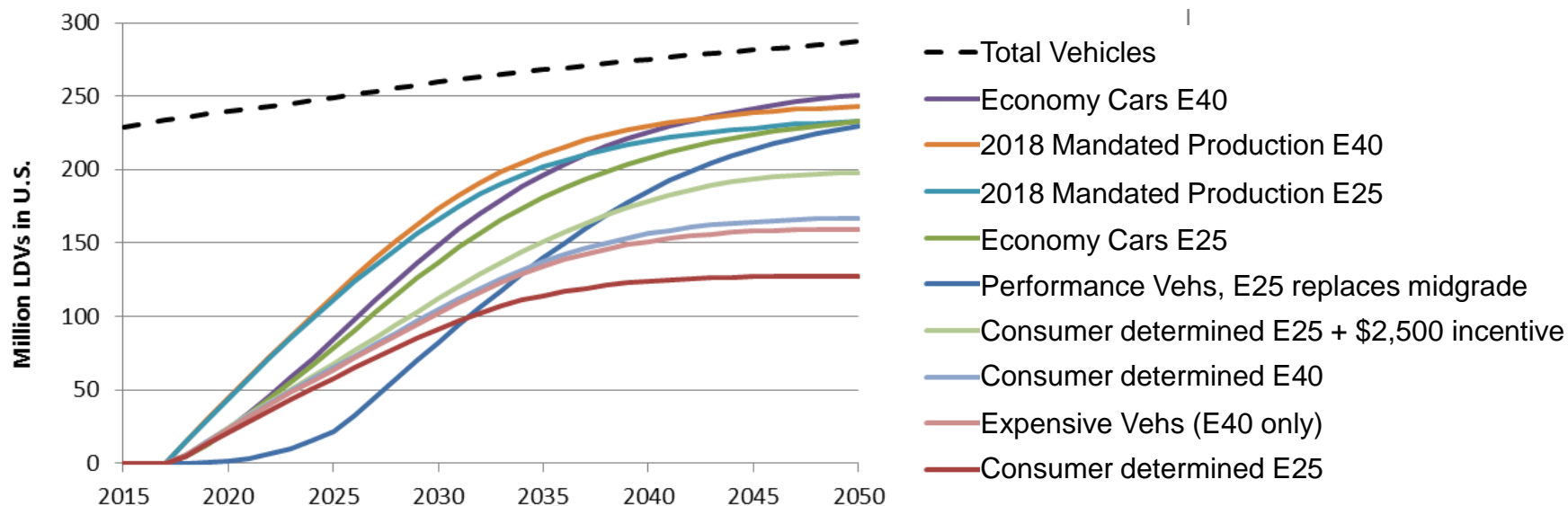
† Higgins, T. (2014). "Octane Number Outlook." Presentation to the 2014 SAE High Octane Fuels Symposium.

Hurdles and Resolutions to HOF Adoption

30 hurdles 94 potential resolutions identified, categorized, and discussed

Tracking #	Hurdle	Type	Drivers	Vehicle Mfrs.	Fuel Retailers	Fuel Producers
1	Level 1 hurdles (most formidable hurdles—show-stoppers if not properly addressed)					
1.1	Challenges building supply and demand in concert with one another	Logistical	X	X	X	X
1.2	Investments in ethanol face regulatory risk	Regulatory		X	X	X
1.3	Misfueling legacy vehicles on HOF	Behavioral	X	X	X	
1.4	HOF is not currently a certification fuel, needs to be “readily available and used” first	Regulatory		X		
1.5	Reid Vapor Pressure (RVP) of E25 (with current blendstock) would be too high, and therefore illegal	Regulatory				X
1.6	HOF is not an EPA-registered fuel	Regulatory			X	X
1.7	Future CAFE calculation may not adequately reward HOFVs for improved efficiency	Regulatory		X		
1.8	Cost of upgrading a retail station to offer HOF	Economic			X	
1.9	Problem if HOF price exceeds that of regular gasoline	Economic	X	X	X	X

Vehicle Market Adoption Simulation



- All scenarios achieved a substantial percentage (43%–79%) of the light-duty vehicle stock by 2035
- More HOFVs are adopted if HOF is E40 (vs. E25) if they offer greater fuel cost savings and GHG benefit
- \$2,500 purchase incentive boosted 2035 penetration 32% in consumer determined scenarios
- Designating certain vehicle models to be HOF-dedicated leads to higher adoption rates but early adoption speed depends on model production volumes

Fuel Supply Chain Simulation

Results show potential for significant HOF consumption in 2035 under the scenarios modeled

- 75 billion gallons of E40 (30 billion gallons of ethanol)
- Over 60% of 2035 LDV fuel market

Where are the bottlenecks?

- **Fuel retailers' investment in HOF equipment is limiting factor in most scenarios**
 - **Unless** incentivized to invest, equipment cost is reduced, or if only compatible equipment is sold in advance. In which case:
- **Construction rate of new biorefineries is limiting factor**
 - **Unless** enough time passes to allow construction to catch up (circa 2025). In which case:
- **HOF vehicle adoption is limiting factor**
 - Only in scenarios where adequate retailer investment has been made and biorefinery construction has caught up with demand (post 2025)
- **Feedstock availability and cost are not the limiting factors in any scenarios**

