Disclaimer: The opinions and views expressed herein do not necessarily state or reflect those of the individuals on the Fuels Institute Board of Directors and the Fuels Institute Board of Advisors, or any contributing organization to the Fuels Institute. They are exclusively those of the speaker.
Disruption?

What is the compelling consumer benefit of new transportation options?
Future of Electrification
Ford Goes ‘All In’ on Electric Cars

If it seems like every carmaker is going electric, that’s because they are.

GENERAL MOTORS IS GOING ALL ELECTRIC

Global carmakers to invest at least $90 billion in electric vehicles

Why Electric Cars Could Kill The Convenience Store...And Other Small Business Tech News This Week
BEV & PHEV combined for 1.11% of LDV sales

<table>
<thead>
<tr>
<th>Vehicle Type</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gasoline</td>
<td>94.0%</td>
<td>94.4%</td>
<td>93.5%</td>
</tr>
<tr>
<td>Diesel</td>
<td>3.2%</td>
<td>2.8%</td>
<td>3.2%</td>
</tr>
<tr>
<td>Electric</td>
<td>0.41%</td>
<td>0.46%</td>
<td>0.58%</td>
</tr>
<tr>
<td>Plug-In Hybrid</td>
<td>0.25%</td>
<td>0.40%</td>
<td>0.53%</td>
</tr>
<tr>
<td>Hybrid</td>
<td>2.14%</td>
<td>1.93%</td>
<td>2.11%</td>
</tr>
<tr>
<td>NatGas</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Fuel Cell</td>
<td>0%</td>
<td>0.01%</td>
<td>0.01%</td>
</tr>
</tbody>
</table>

Share of LDV Sales by Power Source, 2015-2017

Source: WardsAuto
Electrified vehicles show strong growth rates

Total BEV and PHEV Vehicles Sold, 2015-2017

Source: WardsAuto
Penetration of New Vehicle Technology

Assumptions
EIA Forecast LDV Fleet Size (2017 = 244.6 million)
EIA Forecast LDV Sales (Avg 16.6 million/year)
New Tech: All units from Jan 1, 2017

Takes 7 years to hit 50% market share with 100% conversion

Source: Fuels Institute
An optimistic EV growth curve through 2035

Even with aggressive sales growth, BEV & PHEV would combine for 10% of vehicles on road in 2035

Assumptions
U.S. EIA Forecast LDV Fleet Size
U.S. EIA Forecast LDV Sales
Rate of Sales Growth BEV & PHEV = 26% 2017-2025
Rate of Sales Growth BEV & PHEV = 20% 2026-2035

Source: Fuels Institute
The Case for Octane
Optimize fuels and engines with octane

Engine Efficiency from Higher Octane Fuel (HOF)

HOF enables efficiency increases for all vehicles with SI engines including hybrid electric vehicles


Slide information taken from USCAR presentation in Jan 2018
The Current Octane Market

The range of octane in the market requires broad calibrations for engine manufacturers, reducing overall efficiency.

<table>
<thead>
<tr>
<th>Country &amp; Region</th>
<th>Predominant Posted Octane (AKI)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Premium</td>
</tr>
<tr>
<td>United States</td>
<td></td>
</tr>
<tr>
<td>PADD 1</td>
<td>93</td>
</tr>
<tr>
<td>PADD 2</td>
<td>93</td>
</tr>
<tr>
<td>Eastern</td>
<td></td>
</tr>
<tr>
<td>Western</td>
<td>91</td>
</tr>
<tr>
<td>PADD 3</td>
<td>93</td>
</tr>
<tr>
<td>East &amp; Central</td>
<td></td>
</tr>
<tr>
<td>West Texas &amp; New Mexico</td>
<td>91</td>
</tr>
<tr>
<td>PADD 4 (Mountain States)</td>
<td>91</td>
</tr>
<tr>
<td>PADD 5</td>
<td>91</td>
</tr>
<tr>
<td>Calif., Ariz., &amp; Nev.</td>
<td>91</td>
</tr>
<tr>
<td>Oreg., Wash. &amp; Hawaii</td>
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</tr>
<tr>
<td>Alaska</td>
<td>90</td>
</tr>
<tr>
<td>Canada</td>
<td>91</td>
</tr>
<tr>
<td>Mexico</td>
<td>92</td>
</tr>
</tbody>
</table>
DRAFT RESULTS
Refinery Screening – Impact of Ethanol

Additional refinery production costs, plus purchase of ethanol (Cents per Gallon)

**Effect of Ethanol Cost Estimates**
At $90/bbl, ethanol adds $0.21 to E20 vs E10 and $0.42 to E30 vs E10. One can assume, given the numbers in this analysis, that E20 and E30 would reduce refinery costs to produce required BOBs.

**Incremental Cost to Produce Candidate Fuels for 100% of Fuel Pool**

- **95 RON**
  - E10: 5
  - E20: -11
  - E30: -32

- **98 RON**
  - E10: 10
  - E20: 10
  - E30: -27

- **100 RON**
  - E10: 20
  - E20: 15
  - E30: -27

- **102 RON**
  - E10: 42
  - E20: 21
  - E30: -18
Possible Action in Washington, DC

- USCAR Proposal
  - 95 RON as new fuel for all new vehicles
  - Essentially today’s 91 AKI premium
  - OEMs claim = 3% efficiency gain
  - Would enable 2025 CAFE compliance
  - All new vehicles required to use new fuel
- Formulation could be E10 or E15 or higher
- Eventually, 87 AKI and 89 AKI would fade from market
- Misfueling prevention for new vehicles required
- Refiners seek RFS reform in exchange
- Biofuels industry not supportive
Typical Major Fuel Rulemaking Timeline

1. **Analysis and Evaluation of Need/Potential/What to do**: 1-10 years
2. **Proposed Rule Development**: 1-2 years
3. **Interagency Review**: 1-3 months
4. **Proposed Regulations**: 2-4 weeks
5. **Public Hearing**: 2 weeks
6. **Public Comment Period**: 1-3 months
7. **Reassessment, Final Rule Development, Response to comments**: 1-1.5 years
8. **Interagency Review**: 1-3 months
9. **Final Rule Signed**: 2-4 weeks
10. **Congressional Review**: 2-3 months
11. **Litigation ??**: 0-2 years
12. **Implementation Lead time**: 1-4 years
13. **Phase-in**: 0-10 years

Source: Paul Machiele, US EPA, FUELS2018 Presentation
Annual cost of fuel production and infrastructure investments (spread evenly over 12 years) after HOF introduced to the market

**Total Cost of Each Scenario**

- **Cumulative Cost**
  - Scenario 1: $188 Billion
  - Scenario 2: $106 Billion
  - Scenario 3: $127 Billion

**Per Gallon Cost of Each Scenario**
Future of Fuel Retailing
Has fuel’s relative importance diminished?

As a percent of store margins, fuel has lost ground to foodservice and merchandise – but 45% of fuel customers go inside the store.

Source: NACS State of the Industry Report; NACS Fuels Resource Center

Sales and Margins Contributions – 2013 vs 2017

- **2013 Sales**: 75.3%
  - Fuel: 5.1%
  - Merchandise: 19.6%
  - Foodservice: 38.4%
  - Other: 30.8%

- **2017 Sales**: 60.3%
  - Fuel: 8.9%
  - Merchandise: 30.8%
  - Foodservice: 33.0%
  - Other: 22.6%

- **2013 Margins**: 33.0%
  - Fuel: 75.3%
  - Merchandise: 30.8%
  - Foodservice: 33.0%
  - Other: 18.4%

- **2017 Margins**: 27.4%
  - Fuel: 18.4%
  - Merchandise: 38.4%
  - Foodservice: 33.0%
  - Other: 22.6%

Retail price dropped 31%
Retail facilities may need to be “rethought”

why do fuel positions need to be in front of the shop
why do fuel positions need to be in front of the shop
Liquid fuels remain the lifeblood of the market

- More than 90% of vehicles on U.S. roads in 2035 will run primarily on liquid fuels
- Demand will decline over time with improved efficiency, electrification, etc.
- Retailers are seeking ways to better compete for fewer gallons and maintain customer traffic
- Options provide opportunities
  - Liquid fuel varieties
  - EV Charging stations
  - Total car care services
  - Improved in-store offers
  - Partnerships & Social Responsibility
Closing Thoughts

- Disruption highly unlikely – transportation market evolves slowly
- Electric vehicles will represent majority of fleet – someday
  - Internal combustion engines are not going away anytime soon
  - Increasing ICE efficiency is key – but there are many options
- Potential to leverage high octane fuel for greater efficiency
  - Market challenges could be significant
  - Legislative and regulatory paths are uncertain
  - Slowing of CAFE regulations mitigates urgency to act
- Fuel retailing will change dramatically over time
  - How to create a destination independent of fuel?
  - How to capitalize on new transportation energy demand?
Thank you!

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