ETHANOL INDUSTRY OUTLOOK

For - Council of State Governments - Midwest

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Who We Are and What We Stand For

RFA is the national trade association for America's ethanol producers

- We represent companies that own and operate more than 60 ethanol biorefineries and other renewable fuel facilities across the United States.
- Our membership also includes biofuel advocates, technology providers, vendors, farmers and others who contribute to the renewable fuels value chain.

Celebrating 40 Years of Leadership

- Founded in 1981, RFA is the nation's oldest and most experienced biofuels advocacy organization.
- We've been at the forefront of every major legislative, regulatory, and legal victory in the industry's history.

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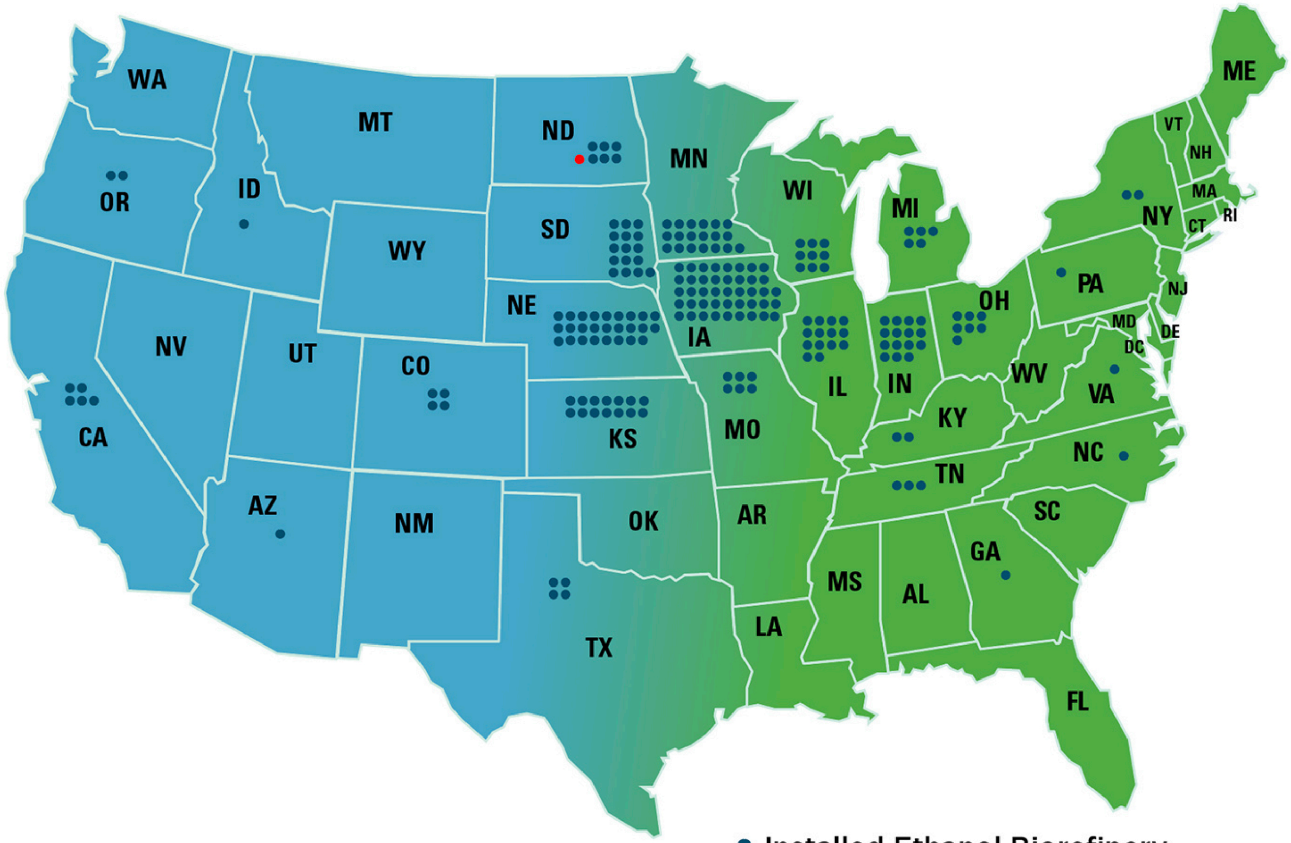
Ethanol Industry Profile

U.S. ETHANOL BIOREFINERIES BY STATE



● Installed Ethanol Biorefinery
● New Biorefinery under Construction

HISTORICAL BIOREFINERY COUNT & PRODUCTION CAPACITY

Year	Installed Ethanol Biorefineries	Total Installed Production Capacity (mgy)	Average Capacity per Biorefinery (mgy)
2000	56	2,007	36
2005	95	4,294	45
2010	204	14,073	69
2015	214	15,594	73
2020	208	17,436	84

*Source: RFA * As of December for each year specified*

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Current State of the US Ethanol Industry…

- **Current state of production**:
  - Year 2000 – 56 plants, 2 BG annual capacity, ave. cap. 36 MGY/plant.
  - Year 2020 – 208 plants, 17.4 BG annual capacity, ave. cap. 83 MGY/plant.
  - Over 5 billion bushels of corn begins being processed at a US ethanol plant.
  - In 2020, ethanol added $1.27, or 37% to every bushel of corn processed.
  - In 2020, 62,180 direct jobs, 242,600 indirect jobs, $18.6B household income, $34.7B in GDP contribution.

- **Renewable fuels has weathered a multi-year storm**:
  - Dozens of Small Refinery Exemption's (SREs) issued from 2017-2020
  - Renewable Volume Obligations (RVO's) not being met
  - The battle for year-round E-15, Trump giveth, 10th Circuit taketh away
  - COVID-19 pandemic, lost demand leads to indirect loss of $5 billion
  - 200,000 barrels/day remain off-line, or transitioned to industrial use

- **Preserve what we have, expand where we can:**
  - Rebuild and fortify the RFS (legislative, regulatory, legal)
  - Explore other opportunities (low carbon, new uses, exports)

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Ethanol Has a Substantial Economic Impact

	2019	2020
Direct jobs	68,542	62,180
Indirect/Induced jobs	277,389	242,600
Household income	$22.9 billion	$18.6 billion
GDP contribution	$42.8 billion	$34.7 billion

Ethanol biorefineries offer skilled jobs and good wages in rural communities where attractive employment opportunities are often hard to find.

1 in 5 employees is a military veteran —more than triple the national average.

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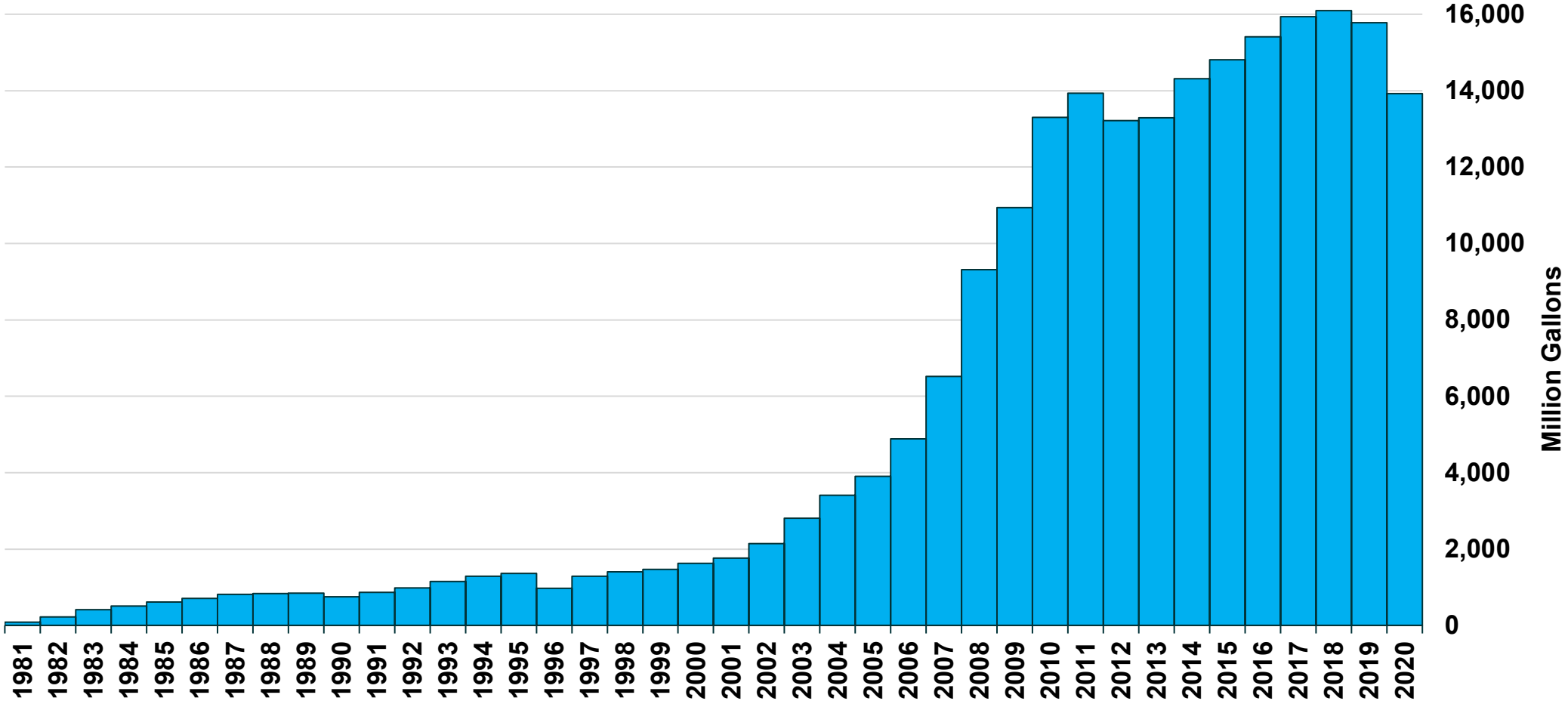
Historical U.S. Ethanol Production



Source: RFA and U.S. Energy Information Administration

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State Activity Around the Country…

- **Numerous states exploring/passing legislation focused on LCFS:**
  - CA's LCFS - 10 years old, setting a trend.
    - State policy focuses ratcheting down the amount of carbon emissions allowed from energy sources.
    - Initially touted as a policy favoring EV's, over 80% of the LCFS reduction requirements have been met by biofuels.
  - Oregon and Washington have more reasonable LCFS.
  - Other states continue LCFS/CFS policy development (Minnesota, New Mexico).
  - Numerous states/entities looking at a Midwest clean fuels policy standard https://www.betterenergy.org/blog/midwestern-clean-fuels-policy-101/
- **CA Governor executive order - banning the sale of ICE vehicles by as year certain, others may follow.**
  - This concept needs to be push back whenever possible. The focus should be on carbon reduction and technology neutral.
- **Other states looking at ways to expand E15**
  - States looking at some form of E15 retail requirements (IA, OH)
  - States exploring ways to opt out of the RVP 1lb waiver under EPA guidelines.

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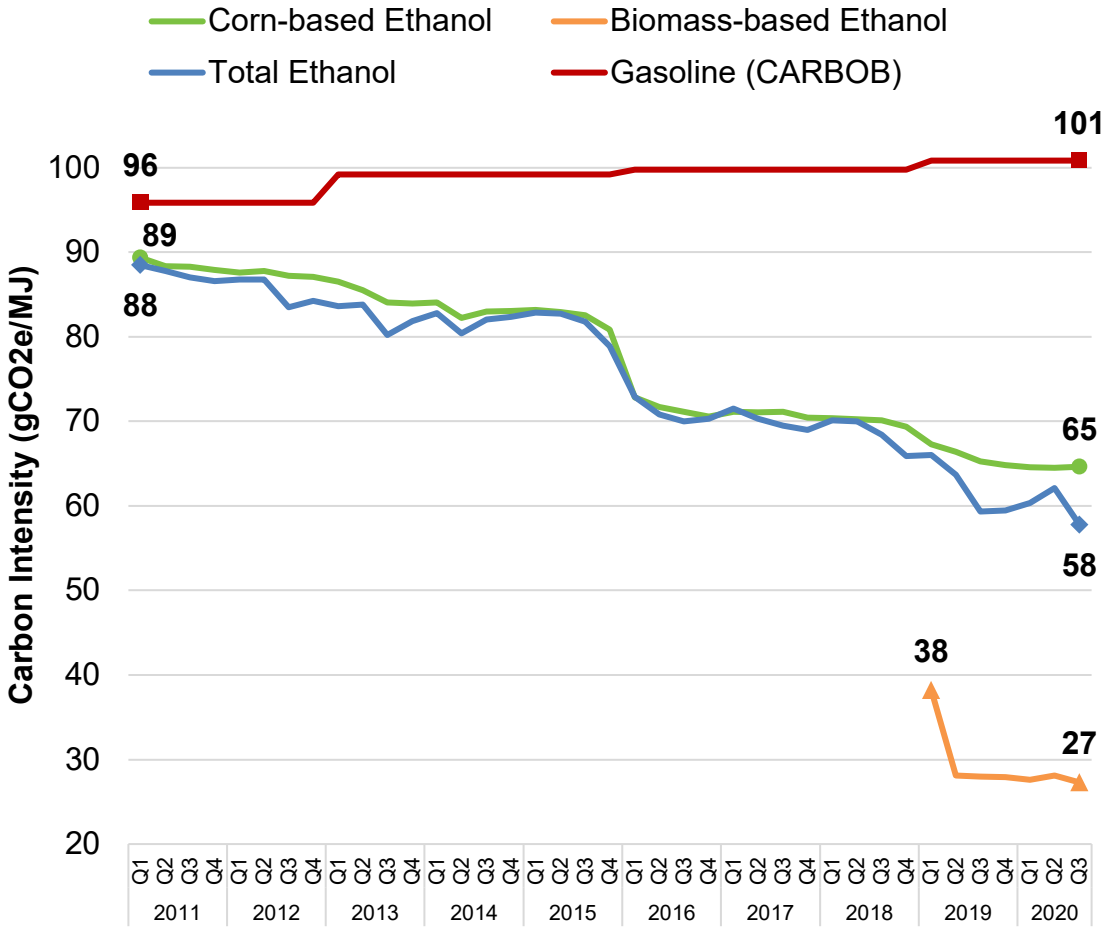
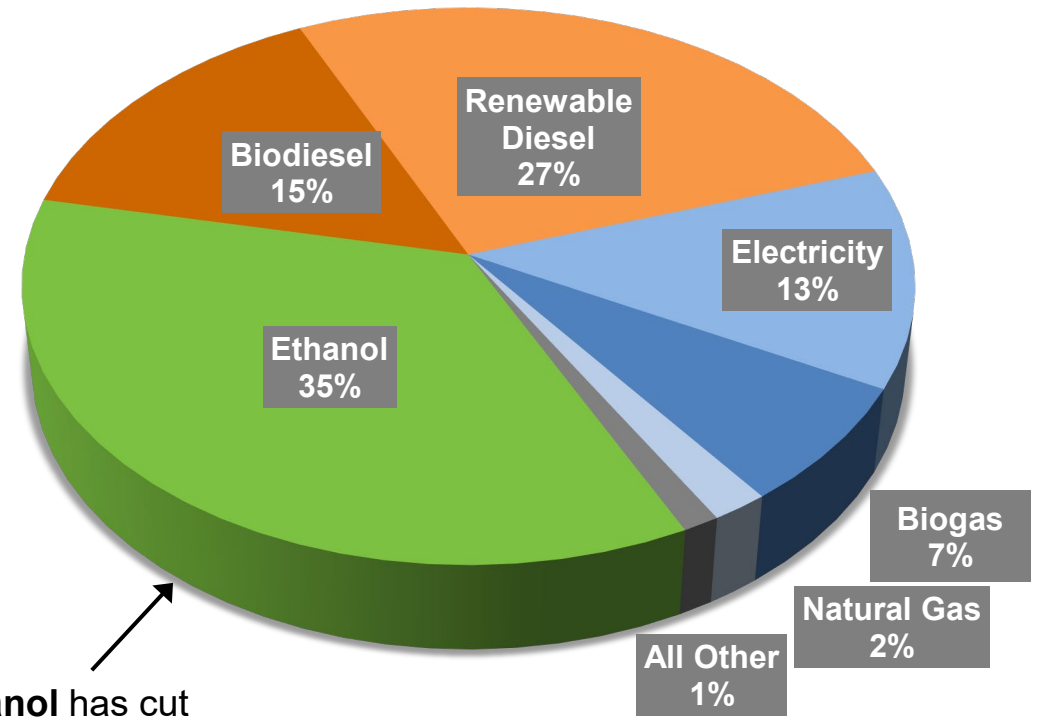
Near-term Decarbonization: Ethanol Has Been the Leading Source of GHG Savings in California

Ethanol's Carbon Intensity Has Decreased



Share of GHG Emissions Reductions Under the LCFS, by Fuel Type



Ethanol has cut emissions by **26 million metric tons**

Source: CA Air Resources Board

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Opportunities for Renewable Fuels…

- **Support legislative/regulatory efforts that could lead to increased demand**
  - Next Generation Fuels Act (high octane, low carbon)
  - LCFS/CFS legislation? Development of a carbon-based tax credit system
  - HBIIP/FFV incentives legislation
  - Need a solution for year-round E15 (legislative or regulatory)
- **How low can we go?**
  - A global movement to de-carbonize the energy/transportation sector.
  - Corn-based ethanol could be carbon-negative in the coming decades.
  - RFA members unanimously committed to 70% reduction by 2030, net zero by 2050.
  - On-farm carbon accounting, CCS technology will be important.
- **De-carbonizing could lead to new uses**
  - Bio-refining – all products made petro-chemically can be made in a bio-refinery
  - A source for hydrogen (C2H5OH)
  - Sustainable aviation fuel (SAF)
  - Ethanol to electrons

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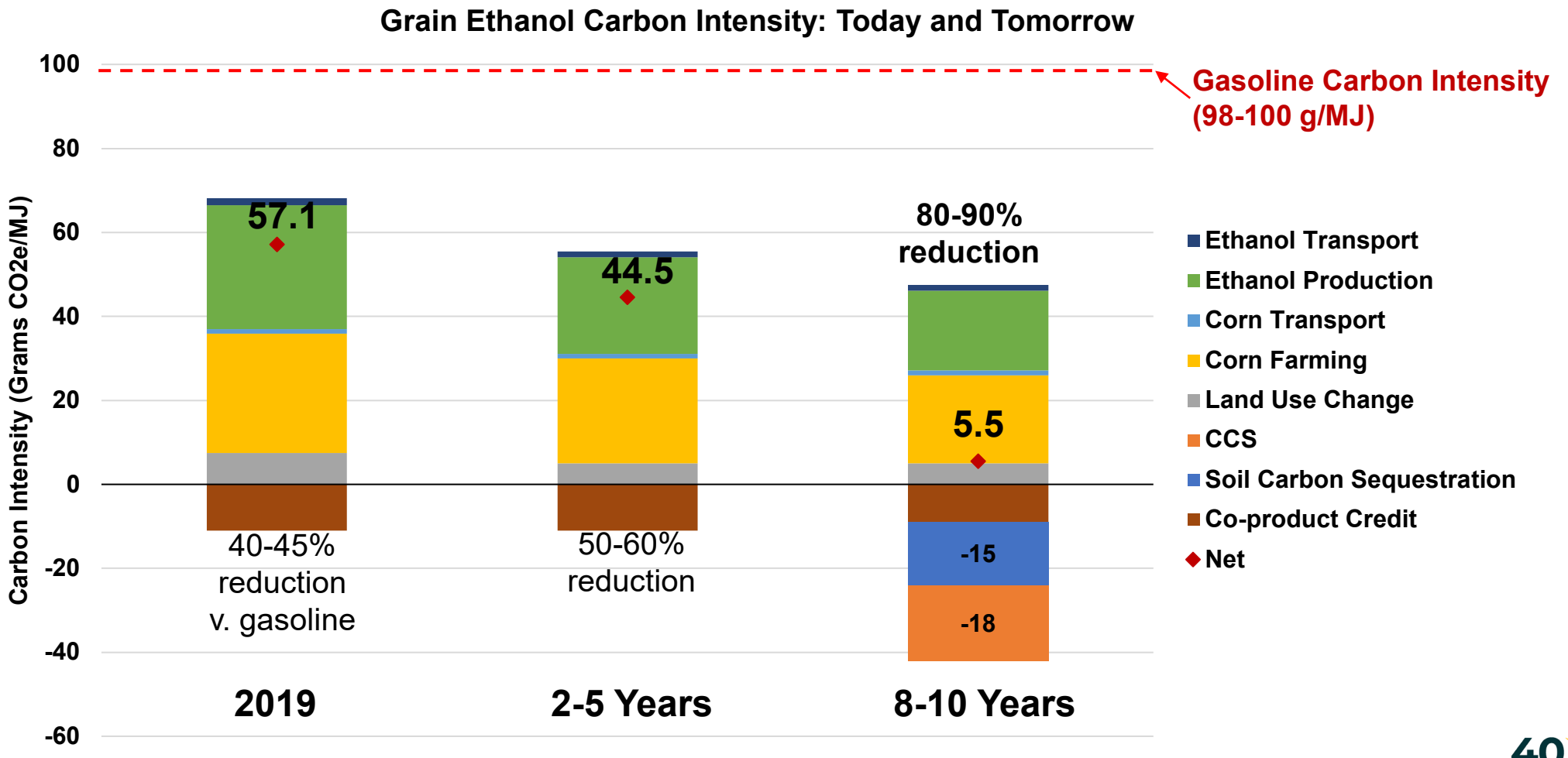
Ultra Low-Carbon Corn Ethanol Is Coming, and Ethanol Has the Potential to Be Carbon Negative



Source: RFA analysis using GREET1_2019 and user-defined assumptions/projections

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Long-term: Low-Carbon Ethanol Can Be Synergistic with Electric Vehicle Technologies

- **A hybrid flex-fuel electric vehicle running on E85 flex fuel or other high-octane ethanol blend would extend vehicle range while substantially reducing GHG emissions**
  - Toyota already introduced a flex-fuel hybrid Corolla in Brazil
  - Depending on sources of electricity and ethanol, vehicle can be truly "zero emissions"
- **A recent study concluded: "High octane fuel vehicles with ethanol provide very similar GHG savings compared to EVs … for many states. Importantly, HOF plug-in hybrids are the lowest GHG emitting technology."[1]**

[1] Mueller, S., & Unnasch, S. (2021). High Octane Low Carbon Fuels: *The Bridge to Improve Both Gasoline and Electric Vehicles*. https://erc.uic.edu/wp-content/uploads/sites/633/2021/03/UIC-Marginal-EV-HOF-Analysis-DRAFT-3_22_2021_UPDATE.pdf

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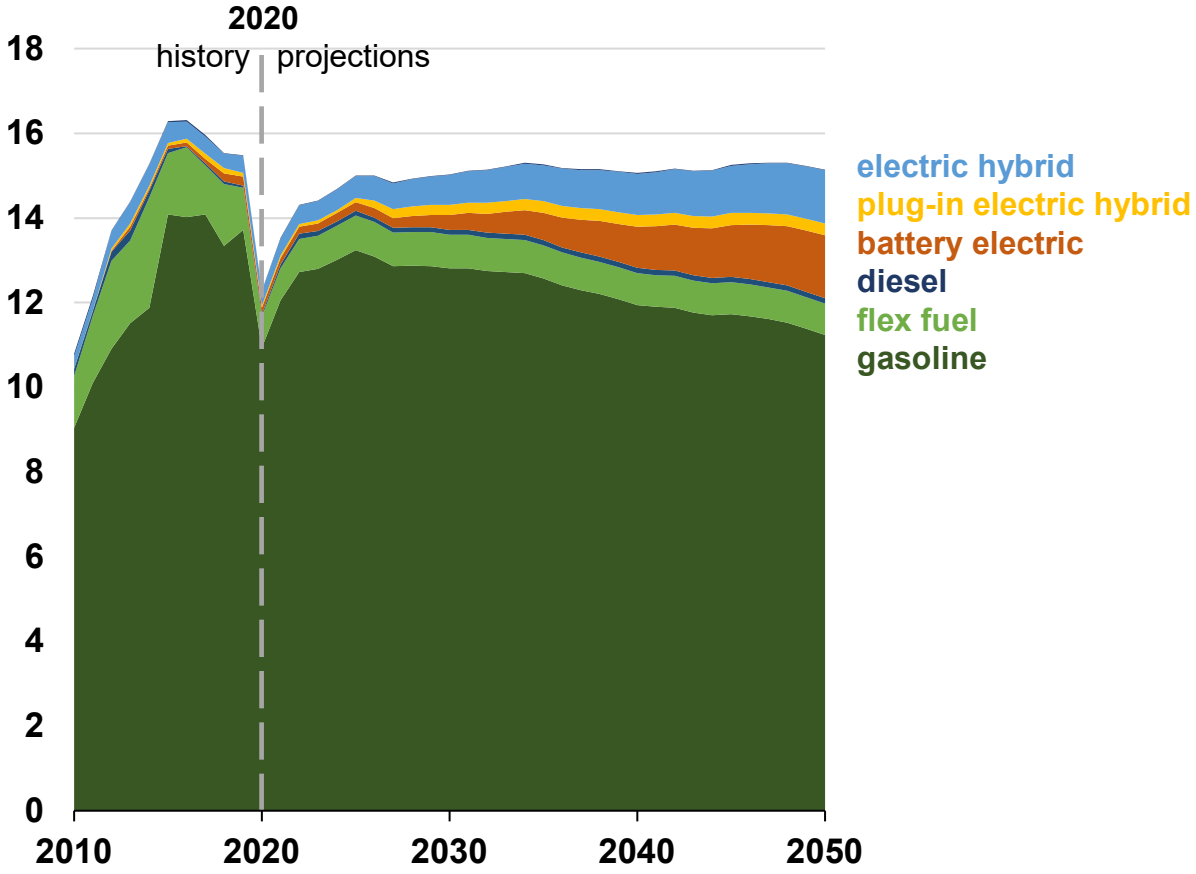
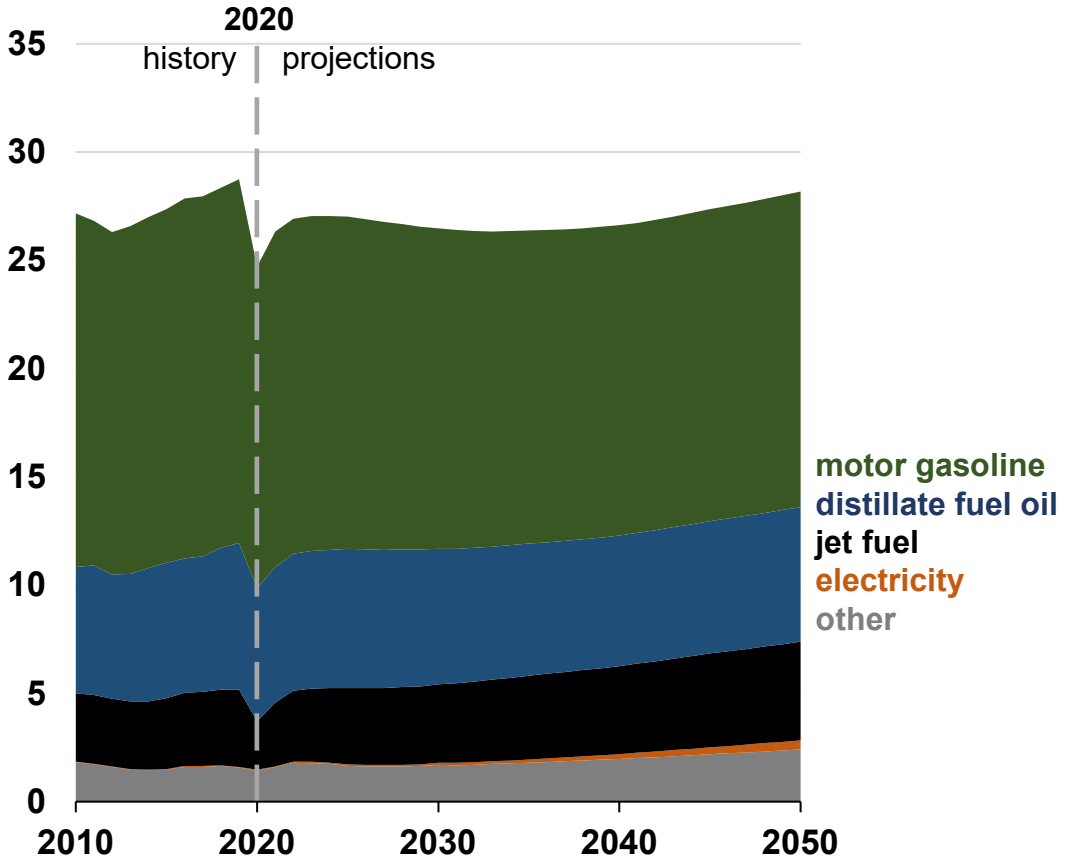
EIA: Liquid fuels continue to dominate transportation sector through 2050

Light-duty vehicle sales by technology/fuel
millions of vehicles



Transportation sector consumption by fuel
quadrillion British thermal units



Source: Energy Information Administration, 2021 Annual Energy Outlook

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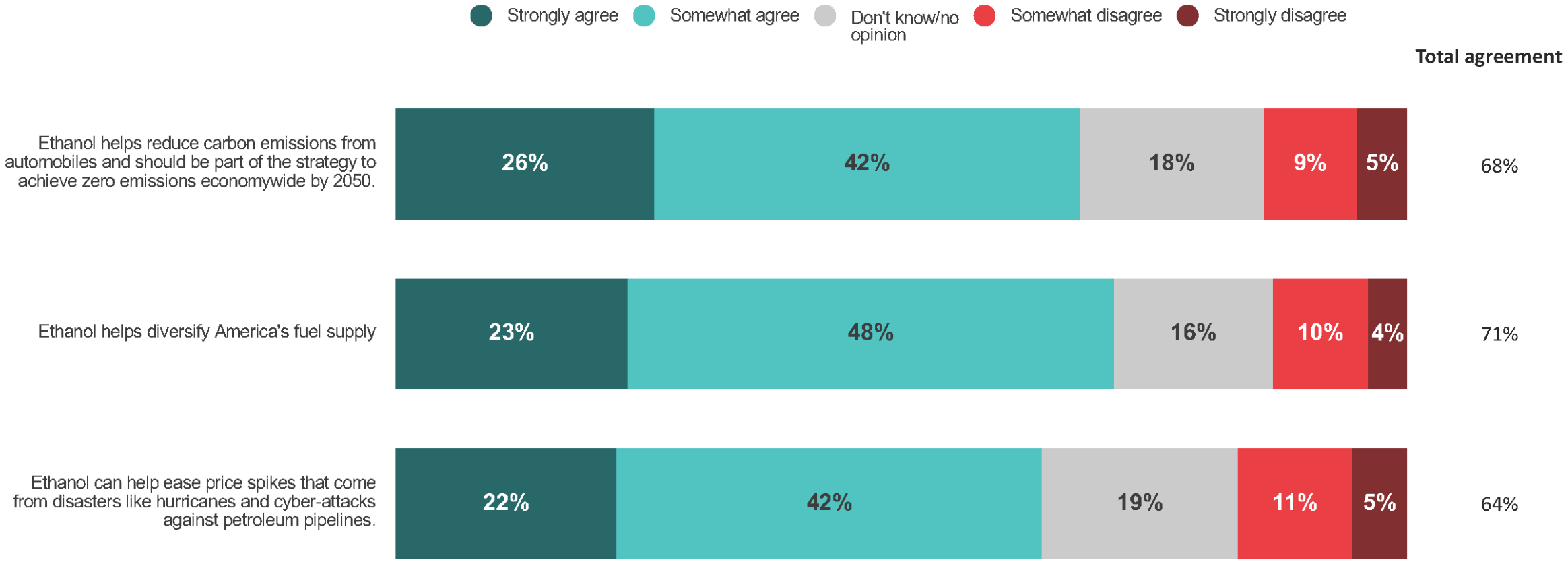
FUTURE USE OF ETHANOL

Approximately two third of voters agree that ethanol should be part of the strategy to achieve zero emissions economywide by 2050 (68%), helps diversify America's fuel supply (71%), and can help ease price spikes that come from disasters (64%).

Based on what you know, do you agree or disagree with the following statements?



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