MARYLAND
BIOFUELS
TASK FORCE

Maryland Biofuels Task Force Report

An Assessment of the Challenges, Costs, Benefits, Risks, and Feasibility of Utilizing Higher Blends of Biofuels to Help Decarbonize Maryland's Transportation Sector

(Final Draft: December 15, 2025)

Prepared For

Greater Washington Region Clean Cities
Maryland Biofuels Task Force

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Maryland Biofuels Task Force Overview

The Task Force

A diverse group of stakeholders from non-governmental, governmental, and private industry with expertise in economic, energy, and environmental policy and technologies established the Maryland Biofuels Task Force (Task Force) and the Organizing Committee (OC). The Task Force was established to assess the challenges, costs, benefits, risks, and feasibility of utilizing higher blends of biofuels to help decarbonize Maryland's transportation sector. Increasing the use of biofuels provides another decarbonization tool in addition to what is achieved with EVs – not instead of any other viable alternative fuel option.

Research objectives:

1. Identify existing and potential economic, energy, environmental, public health, and national security-related barriers and challenges preventing the state from achieving its carbon reduction goal.
2. Identify opportunities and make recommendations to overcome those challenges.
3. Evaluate the role of biofuels (ethanol, biodiesel) in reducing emissions, considering their feasibility, safety, and cost-effectiveness, as well as the impact on Maryland's resources and economic, energy, environmental, and public health security challenges and goals.
4. Quantify the total societal costs/benefits that could be gained if recommendations are implemented or lost if no actions to change the status quo are taken.

A Public Education & Stakeholder Engagement Campaign

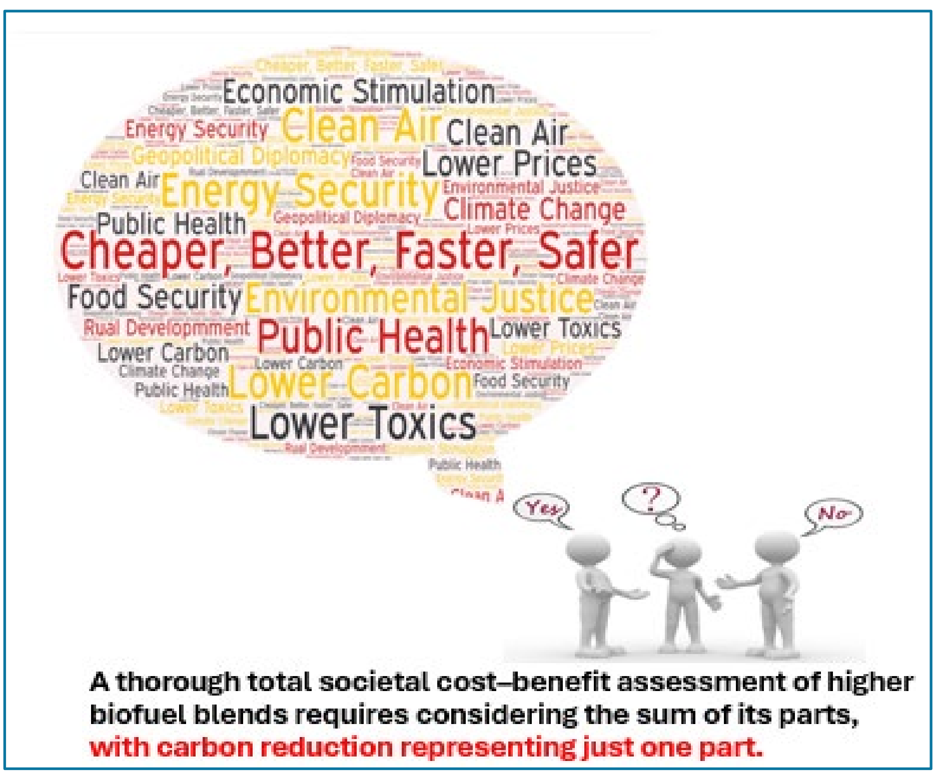
Priority Research Areas for the Task Force Report

1. **Policy Alignment and Practical Pathways**
    a. How would a transition to higher blends of biofuels in Maryland align with the state's existing legislation and policy framework, including the Climate Solutions Now Act?
    b. Could such a transition deliver measurable benefits in economic, energy, environmental, food, and personal security for Maryland residents, while also advancing U.S. national security?
    c. To what extent are higher biofuel blends a low-cost, efficient, safe, and immediately deployable solution for reducing carbon and mobile source emissions from both legacy and new internal combustion engine (ICE) vehicles in Maryland?

2. **Costs, Benefits, and Consequences of Action vs. Inaction**
    a. What are the full costs, benefits, trade-offs, and consequences of accelerating the adoption of higher biofuel blends compared with maintaining the status quo?
    b. How do the total societal costs of fossil fuels compare to the total societal benefits of biofuels when substitution is feasible?

3. **Public Awareness, Consumer Value, and Education**
    a. What value propositions can be established to guide a consumer awareness and education campaign on biofuels?
    b. How can lessons from past public campaigns (e.g., seatbelt use, clean fuels, smoking cessation, distracted driving) inform strategies that build recognition of biofuels as solutions for safer communities, cleaner air, healthier families, stronger farms, and a more secure economy?
    c. What messages resonate with consumer behavior patterns—such as willingness to pay for organic foods, bottled water, or modern communications—that demonstrate how perceived value drives acceptance of innovation and policy?

Figure 1: The Benefits of Biofuels Are Equal to the Sum of Their Parts



Task Force Report Overview

Purpose

Maryland's Climate Solutions Now Act (CSNA) requires a 60% reduction in greenhouse gas (GHG or carbon) emissions by 2031.[1] To meet this ambitious goal, every sector must contribute, and transportation stands out as the most immediate opportunity. With 35–36% of Maryland's emissions coming from transportation—and 82% of those from on-road vehicles—achieving meaningful reductions requires action beyond the adoption of electric vehicles alone.[2] While electricity production has reduced emissions by 66% since 2005 through coal retirements and the adoption of renewables, transportation remains Maryland's largest source of emissions.[3]

Therefore, increasing the amount of biofuels in gasoline and diesel fuel presents an underutilized but essential tool in this transition, offering immediate carbon reductions, consumer savings, and economic benefits while reinforcing energy and food security.

Background

The Maryland Department of the Environment (MDE) estimates that meeting CSNA targets by reducing carbon emissions by 646 million metric tons would generate $135 billion in total societal benefits, lower healthcare costs, avoid climate damage, and strengthen economic resilience.[4]

Federal rollbacks of clean car and truck programs have created new urgency at the state level. In light of the federal government's rollback of the Advanced Clean Cars and Advanced Clean Trucks programs and federal fuel efficiency standards, the Maryland Climate Change Commission Mitigation Working Group (MWG) is recommending the adoption of a Clean Fuel Standard. MDE is considering incorporating the U.S. Department of Energy's GREET-based analysis into its current modeling program. This would allow Maryland to recognize the carbon benefits of biofuels and integrate them into its CSNA compliance pathway.

Key Insights

- **Premature deaths prevented:** Transitioning to E15 gasoline and B20 biodiesel in Maryland could prevent **~30 premature deaths per year**, primarily from reductions in fine particulate matter ($PM_{2.5}$) exposure.
- **Carbon reduction:** The combined fuels scenario would avoid nearly **3.0MMT of CO_2 annually**, equivalent to taking almost **1 million gasoline cars off the road each year**.
- **Particulate matter reduction:** Biofuel use lowers primary and secondary $PM_{2.5}$ emissions from on-road vehicles, reducing the pollutants most directly linked to respiratory and cardiovascular disease.
- **Benzene and toxics:** Higher ethanol blends dilute aromatics like benzene in gasoline, cutting emissions of a known carcinogen and reducing cancer risk from mobile sources.

- **Cumulative health and equity benefits:** Lower levels of PM and toxic emissions deliver disproportionate benefits in urban and roadside communities, where exposure is highest, and health burdens are most acute.
- **Societal value of carbon reduction:** Using Maryland's official valuation of **\$209 per ton of CO_2**, the annual 3.0MMT reduction from E15 and B20 equates to more than **\$624M in avoided societal costs each year**, and over **\$3.1B in five years**.

Economic Benefits from Carbon Reduction with Biofuels

Maryland has a unique opportunity to capture immediate and scalable benefits by expanding the use of biofuels. The transition to E15 gasoline and B20 biodiesel not only cuts carbon emissions but also delivers measurable economic, energy, and public health gains. Transitioning to higher blends of biofuels can lower fuel costs for consumers, generate new tax revenues, and support farm income and rural economies. At the same time, they enhance energy and national security by reducing dependence on imported oil and aligning Maryland with other states that have adopted clean fuel standards.

The following tables highlight the potential outcomes of such a transition, including the avoidance of millions of metric tons of carbon emissions annually, billions of dollars in societal benefits, and the prevention of dozens of premature deaths each year. Together, this evidence demonstrates how biofuels can serve as a practical, near-term strategy for meeting Maryland's climate, economic, and public health goals.

Economic Benefits

- \$0.20–\$0.40 per gallon lower gasoline costs, saving Maryland consumers \$569M–\$1B annually.
- \$4.7B in total annual economic activity, including value-added processing and farm income stability.

Energy & National Security Benefits

- U.S. biofuel production (21B gallons per year) is three times larger than the Strategic Petroleum Reserve.
- Like SPR releases, expanded biofuel supply reduces fuel prices and strengthens national resilience.
- Reduced dependence on foreign oil bolsters Maryland's and the nation's energy security.

Policy Alignment

- States across the U.S. and Canada have already implemented Low Carbon Fuel Standards (CA, OR, WA, NM, BC, and CFR nationwide in Canada).

- Maryland can leverage regional momentum as 11 Northeast and Mid-Atlantic states consider a unified LCFS framework.

Table 1: States with or Considering Low Carbon Clean Fuel Standards

Category	Jurisdictions	Status/Details
Implemented Programs	California, Oregon, Washington, and New Mexico	CA: Operational since 2011.
		OR: Operational since 2016
		WA: Active since 2024
		NM: Passed March 2024, regulations by 2026
Pending Legislation	Minnesota, Illinois, Michigan, New York, Vermont, Massachusetts, New Jersey, Hawaii	Actively pursuing legislation or rulemaking.
2025 Legislative Activity	New Jersey, New York, Illinois, Hawaii, Massachusetts, Minnesota	Bills or rulemaking active in the 2025 legislative sessions
Under Consideration	Pennsylvania, Michigan, Colorado, Vermont	Previously proposed or in working-group discussions
Regional Efforts	11 Northeast/Mid-Atlantic states (CT, DE, ME, MD, MA, NH, NJ, NY, PA, RI, VT).	Analyzing unified LCFS framework[68]
Canada has low-carbon (LCFS) and renewable fuel (CFR) programs	British Columbia (BC-LCFS), Canada (CFR)	BC: 20% CI reduction by 2030
		CFR: 15% CI reduction by 2030 (nationwide, implemented 2023)

Biofuel Use and Carbon Reduction Scenario

To assess the potential of biofuels in Maryland, it was necessary to select a baseline scenario that would provide consistent data for a high-level cost–benefit analysis. The E15 and B20 framework offers a straightforward and accessible case study that strikes a balance between technical detail and ease of use. This approach allows both the public and policy reviewers to better understand, give feedback, and work from a shared foundation.

Baseline data and assumptions:

- Gasoline: 2.8B gallons per year (BGY), E15 (15% ethanol), ethanol CI reduction = 50% vs gasoline.
- Diesel: 788M gallons per year (MGPY), B20 (20% biodiesel), biodiesel CI reduction = 70% vs diesel.

Step 1. Gasoline/Ethanol

- Ethanol gallons (15% of 2.8B) = 420MGY ethanol.
- Baseline CO_2 = 420M × 8.89 kg/gal = 3.735MMT CO_2.
- Apply 50% reduction: 3.735×0.50=1.868MMT CO_2 avoided annually3.735 \times 0.50 = 1.868 \; \text{MMT CO_2 avoided annually}3.735×0.50=1.868MMT CO_2 avoided annually

Step 2. Diesel/Biodiesel

- Biodiesel gallons (20% of 788M) = 157.6 MG biodiesel.
- Baseline CO_2 (all diesel) = 788 M × 10.16 ÷ 1,000,000 = 8.004MMT CO_2.
- Effective reduction for B20 = 70% × 20% = 14%.
- Avoided CO_2 = 8.004 × 0.14 = 1.121MMT CO_2 avoided annually.

Total Annual Carbon Reduction

- 1.868+1.121=2.989 MMT CO_2 avoided annually1.868 + 1.121 = 2.989MMT CO_2 avoided annually}1.868+1.121=2.989MMT CO_2 avoided annually
- **Impact:** ~3.0MMT of CO_2 avoided each year under the E15 + B20 scenario in Maryland.

Table 2: Potential Carbon Reduction in Maryland from Transition to E15 & B20

Fuel Scenario	Calculation	Result
Gasoline (2.8B GPY, E15)	420M gal ethanol × 8.89 kg CO_2/gal × 50% reduction	1.868MMT CO_2 avoided annually
Diesel (788M GPY B20)	8.004MMT CO_2 × 14% effective reduction	1.121MMT CO_2 avoided annually
Total Reduction	Ethanol + Biodiesel	2.989MMT CO_2 avoided annually (~3.0MMT)

Data Sources: U.S. DOE GREET Model.[5] U.S. EPA carbon equivalency calculator.[6]

Value of Carbon Reduction from a Transition to E15 and B20

The value of Maryland's potential carbon reductions under an E15 gasoline and B20 diesel standard can be quantified using the Maryland Department of the Environment's societal cost of carbon estimate. Based on a valuation of $209 per metric ton of CO_2, the transition to E15 and B20—avoiding nearly 3.0MMT of CO_2 annually—would generate hundreds of millions of dollars in societal benefits each year. Over longer horizons, these benefits scale into the billions, underscoring both the economic and environmental case for accelerated adoption.

Baseline valuation: $135B ÷ 646MMT = $208.98 per metric ton CO_2 (≈ $209/t). Apply to E15 + B20 scenario (2.989MMT CO_2 avoided per year):

Table 3: Value of Carbon Reduction from Transition to E15 and B20

Horizon	CO_2 avoided (MMT/yr)	Value per ton	Total value
1 year	2.989	$208.98/t	**$624.6M**
5 years (linear, no discounting)	14.945	$208.98/t	**$3.123B**
"×5" time-to-value lens (5-yr value × 5)	—	—	**$15.616B**

Notes

- Baseline valuation: $135 B ÷ 646MMT = $208.98 per metric ton CO_2 (≈ $209/t).
- Apply to E15 + B20 scenario (2.989MMT CO_2 avoided per year):
- Figures rounded: per-ton to $209; totals to nearest ~$0.1M/$0.001B.
- This is a straight, undiscounted valuation. Option to recalculate with a discount rate (e.g., 3–7%) and show NPV vs. immediate adoption.
- **Source:** Maryland Department of the Environment. A total societal cost of $135 billion for reducing 646 million tons of carbon.[7]

Table 4: Annual CO_2 Reduction Equivalents from 2.989MMT CO_2/yr

Equivalent Impact	Calculation Method
~946,000 EVs on the road for one year	2.989MMT ÷ 3.16 t CO_2 avoided per EV-year
~49.8M seedlings (grown for 10 years)	2.989MMT ÷ 0.060 t CO_2 per seedling
~1.66MMT of coal not burned	2.989MMT ÷ 1.80 t CO_2 per short ton

Biodiesel Carbon Reduction Scenario

- One long-haul truck consumes 25,000 gallons of diesel fuel per year.
- Scenario A Program impact (149.6MGY baseline) expressed in truck-equivalents.
- Assumptions: diesel = 10.16 kg CO_2/gal; total baseline = 1.520MMT CO_2 for 149.6 MG; blend reductions scale approx.: B5 ≈ 3.5%, B10 ≈ 7%, B100/RD100 ≈ 70%.
  One long-haul truck/year CO_2 (see part B): ≈254 t CO_2.

Table 5: Biodiesel Carbon Reduction Estimates

Blend	Reduction vs. diesel	CO_2 avoided per truck/year	Residual per truck/year
B5	3.5%	8.9 t CO_2	245.1 t
B10	7%	17.8 t CO_2	236.2 t
B100 / RD100	70%	177.8 t CO_2	76.2 t

Table 6: Tons & Per Truck Reductions

Blend	Avoided CO_2 (t)	≈ Long-haul trucks *(25k gal/yr)*
B5	53,200	~209 trucks
B10	106,400	~419 trucks
B100 / RD100	1,064,000	~4,190 trucks

Notes: The B5/B10% reductions are rule-of-thumb (linear scaling from B100). DOE GREET pathway-specific CI values (e.g., soy-based, tallow-based, used-cooking-oil RD) can be used for more precise results.

Reduction in Premature Deaths from a Transition to E15 and B20

According to the Oregon Department of Environmental Quality's Modeling Expected Air Quality Impacts of Oregon's Proposed Expanded Clean Fuels Program (April 2022), approximately 30 premature deaths per year could be prevented by Maryland transitioning to an E15 and B20 fuel standard.[8]

Table 7: Estimated Annual Premature Deaths Prevented

Basis	Per-million benefit	Maryland pop. (≈6.2M)	Estimated deaths avoided
Clean fuels policy (PM2.5-driven)	~4.8–5.0 fewer deaths per million people per year	6.2	**~30–31 per year**

Notes on how the data was derived:

- The Oregon Clean Fuels Program analysis found about 4.83 fewer premature deaths per 1,000,000 people per year from reduced PM2.5 under clean-fuel adoption.
- Applying that per-capita result to Maryland's ~6.2M residents yield roughly ~30 prevented deaths annually under a comparable E15 + B20, PM-focused improvement scenario.
- This estimate reflects air-pollution (PM2.5) benefits, not the carbon (CO_2) reduction itself. Actual Maryland outcomes will vary depending on where traffic and populations

are concentrated, the baseline diesel share, and how the blends are deployed; however, the order of magnitude (~30/yr) is a solid, policy-relevant estimate.

Potential Economic Impacts from a Transition to E15 and B20

The transition to higher ethanol and biodiesel blends would generate broad economic benefits for Maryland, spanning agriculture, consumers, and state revenues. Expanded biofuel demand drives additional corn and soybean production, adds value through processing and byproducts, and results in billions of dollars in consumer fuel savings. In total, the shift to E15 and B20 could stimulate more than $4.6 billion in annual economic activity, while also providing measurable relief at the pump and generating new tax revenues for the state.

Impact of Increased Biofuel Supplies on Gasoline and Diesel Fuel Prices

- E15 (15% ethanol blend) is consistently cheaper than E10 (10% ethanol blend) at the pump. Recent studies and industry reports show that E15 typically saves consumers between 10 and 30 cents per gallon compared to E10, with some locations reporting savings of up to $1 per gallon during specific periods. Nationwide, these savings add up. If the U.S. were to switch from E10 to E15 as the standard fuel, consumers could save over $20B annually in fuel costs.
- A study by the Fuels Institute shows biofuels on track to reach a 10% volume share by 2022. A 2022 report estimated that from 2010 to 2021, the global introduction of biomass-based diesel reduced #2 diesel prices by 8% to nearly 19% annually, depending on the year and supply levels. U.S. production alone contributed to a 1–4% reduction in diesel prices. Clean Cities Alternative Fuel Report: On average, during this reporting period, B20 costs $0.44 less per gallon than diesel. Clean Fuels Alliance America (CFAA) reports that U.S. production of biodiesel and renewable diesel has contributed to a 4% reduction in diesel fuel prices. On the national average, that translates to around 22 cents per gallon in savings.
- California Governor Newsom urged CARB to expedite the study to implement increased ethanol blending in gasoline, which could help lower prices by up to $0.20 per gallon and save Californians as much as $2.7 billion annually, with minimal environmental impact.

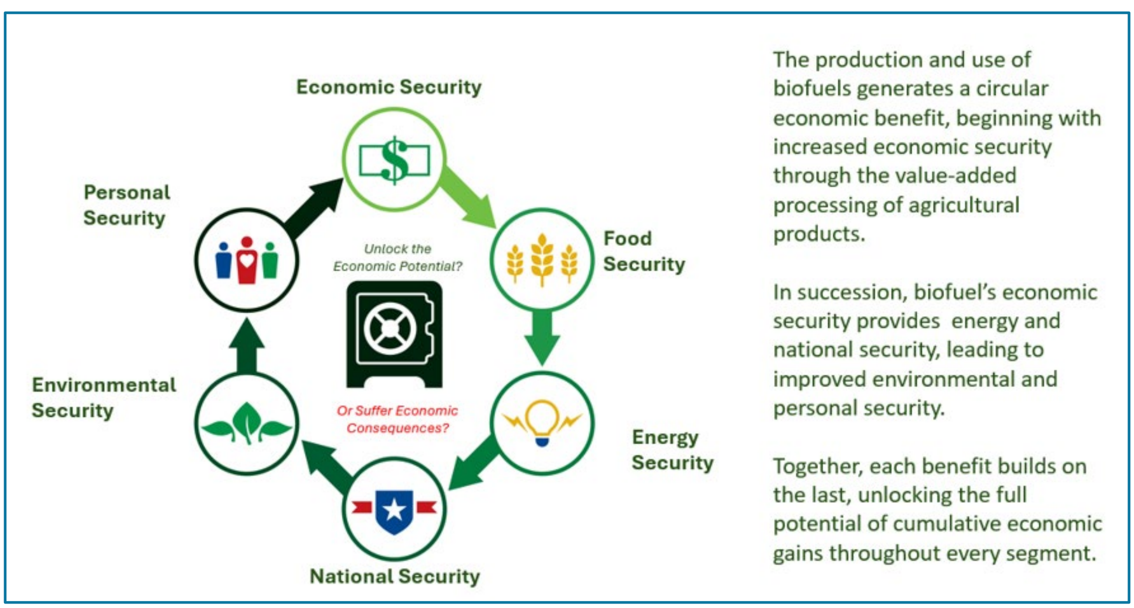
Table 8: Potential Economic Impacts from a Transition to 15% Ethanol and 20% Biodiesel

Increased demand for ethanol (GPY)	188,833,299	
Increased demand for biodiesel (GPY)	44,880,000	
Corn production and value ($4.65/Bu.)	75,533,319 (Bu.)	$351,229,935
Soybean production and value ($12.50/Bu.)	29,920,000 (Bu.)	$374,000,000
The value of valued-added processing. *(ethanol + biodiesel + byproducts)*		$1,041,495,287
Consumer fuel savings ($.20/Gal.)		$2,848,765,970
The annual state tax revenue generated		$60,000,000
Potential Economic Activity Benefit		**$4,683,044,522**

Economic, Energy, and National Security Perspective: U.S. Biofuel Production is a Strategic Fuel Reserve

- 21 BGPY of U.S. biofuel production is 3 times larger than the U.S. Strategic Petroleum Reserve (SPR).
- SPR releases have generally led to lower fuel prices, with Treasury analyses showing price decreases of up to 31 cents per gallon following the 2022 releases.

Figure 2: Total Societal Benefits from Increased Biofuel Production and Use



Maryland's Challenges in Meeting CNSA Goals and the Challenges Preventing Biofuels from Helping the State Achieve the Goals

Maryland's Legislative and Regulatory Challenges

CNSA Investment: To meet the CNSA targets, the Maryland Department of the Environment (MDE) has estimated the need for approximately $1B in additional annual public investment for climate solutions.

State Budget Deficit (Gap): Maryland is projecting a $3B budget gap.

Carbon Reduction Deficit (Gap): As of late 2023, analyses from the Maryland Department of the Environment and the University of Maryland show that "current policies will reduce emissions 51% by 2031," leaving a gap of 10.6MMT of carbon dioxide equivalent (MMT CO_2e) that must be filled by new policy actions and investments to reach the 60% goal.

- **Impact:** If Maryland fails to implement additional measures beyond current policies, the state will fall short of the mandated goal by these 10.6MMTCO_2e—a carbon load equivalent to about 2.35M gas-powered cars driven for one year, or 2.8 coal-fired power plants burning for a year.[9] This shortfall accounts for about one-fifth of the total reduction target.[10]
- **Time-to-Value:** The longer Maryland waits to act, the more expensive it will become to mitigate climate change. Awaiting 5years to reduce carbon will cost 13 times more.

Cost to Implement: Industry observers estimate Oregon's Clean Fuels Program operates on 4.5 FTI. Program administration encompasses LCFS policy development, rulemaking, and implementation, with an annual budget of approximately $500,000.

Changes in Federal Government Policy:

- Loss of funding for EV purchase and recharging infrastructure.
- Potential rollbacks of environmental policies and grants for research and development, as well as funding for the deployment of clean energy technology.
- Tariffs on agricultural products could significantly impact the budget deficit and the state's largest commercial industry, which employs 350,000 people and contributes $8.25B annually to Maryland's economy.
- Reduction in force and funding of federal grants and contracts could significantly impact the state's economy.

Greenhouse Gas Emissions Counting:

Challenge: Maryland's official greenhouse gas (GHG) emissions inventory for vehicles only accounts for the direct, "tailpipe" emissions produced during vehicle operation—specifically, carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) emitted as a result of fuel combustion in the engine.[11] [12]

Maryland uses the U.S. EPA's Motor Vehicle Emission Simulator model (MOVES3) to estimate emissions based on local vehicle activity, fleet mix, and fuel data. The model does not include upstream (or "well-to-wheels") emissions, such as fuel extraction, refining, or electricity generation for electric vehicles, nor does it account for emissions from vehicle manufacturing or disposal.[13]

The focus on tailpipe emissions is standard for state-level GHG inventories and transportation sector reporting. As a result, Maryland's regulatory and inventory framework is limited to vehicle emissions within the state's borders. It is a common accounting practice that states use to avoid double-counting and to simplify or clarify complicated or controversial emissions inventory calculation methodologies.

Background: Lifecycle greenhouse gas analysis came into play decades after the EPA's MOVES model was developed for the Clean Air Act regulatory modeling.[14] The EPA MOVES model was designed to estimate urban air emissions from mobile sources—specifically tailpipe emissions of criteria pollutants and air toxics—for regulatory analysis under the Clean Air Act. The MOVES model is designed to support policy implementation, including state implementation plans (SIPs) and transportation conformity for air quality attainment.

- ***MOVES Focus:*** The MOVES model estimates emissions produced by cars, trucks, and other mobile sources, focusing on exhaust (tailpipe) emissions and some evaporative emissions occurring on or near roadways. Its primary purpose is to calculate urban air pollutant inventories—ozone precursors, particulate matter, CO, and more—for the Clean Air Act requirements.[15]
- ***Carbon Emissions in MOVES:*** Although recent MOVES versions include greenhouse gas pollutants (CO_2, CH_4, N_2O), these are calculated for the on-road combustion stage only. Upstream (fuel production, refining, transport) and downstream emissions are not included; thus, full lifecycle carbon accounting is outside MOVES's scope.[16]
- ***Lifecycle Not Included*:** The concept of comprehensive lifecycle carbon analysis came into regulatory focus much later, with models like GREET and Low Carbon Fuel Standards, and was not a foundation for MOVES design in the Clean Air Act era.[17]

Impact

The MOVES model remains a bottom-up, direct emission inventory tool, not a lifecycle (GREET-like) carbon accounting system. Without regulatory or financial incentives, fuel retailers lack the motivation to invest in higher-blend infrastructure. On the other hand, California (operational since 2011), Oregon (operational since 2016), Washington (implemented in 2023), and Canada (Clean Fuel Regulation/LCFS, implemented in 2023) have addressed this challenge. Biofuel accounts for about 80% of California's carbon credits. This number may soon increase as California passed legislation in September 2026 to allow E15 blending. Before the bill, California was the only state that did not allow E15 blending.

Policy Gaps: Maryland is not utilizing, nor planning to use, higher blends of biofuels to reduce carbon emissions in every legacy and new ICE, hybrid, plug-in, or diesel-powered vehicle sold over the next 10 years.

Table 9: State Legislative and Regulatory Policies to Increase the Utilization of Biofuels

Carbon Reduction Initiatives	2024 Research
Climate Solutions Now Act (CSNA) of 2022	Did not mention ethanol. Mention biodiesel, SAF, and LCFS, but only for "consideration." No incentives or plans to utilize biofuels.
Climate Pollution Reduction Plan	Did not mention ethanol or low-carbon fuels. Mentions biodiesel, but there are no incentives or plans to utilize ethanol or other biofuels.
Transportation Plan	Did not mention ethanol, biofuels, or LCFS. No plans or incentives to utilize biofuels.
Commission of Environmental Justice Program	The Commission's annual report did not mention ethanol, biodiesel, LFS, gasoline, or diesel emissions, nor did it outline any plans or incentives for utilizing biofuels.
Buy Clean Program	The program did not mention biofuels or biobased products. No plans or incentives to utilize biofuels.
Energy Assurance Plan	Did not mention biofuels. No incentives or plans to utilize biofuels.
Maryland Renewable Energy Portfolio Standard Program	Did not mention biofuels. No incentives or plans to utilize biofuels.
MDOT Greenhouse Reduction Plan	Did not mention ethanol, biodiesel, or LCFS. However, the plan states that the National Renewable Fuel Standard (RFS) will reduce CO2e emissions by 2% in 2030.

Context and Perspective Use Casey: Oregon Clean Fuels Program (CFP)[18]

Oregon's Clean Fuels Program is projected to reduce harmful air pollution while significantly cutting carbon emissions. By 2035, the adoption of low-carbon fuels is expected to reduce PM2.5 elemental carbon by 10–20%, organic carbon by 6–10%, and ultrafine PM0.1 by 5–15%, primarily along the I-5 corridor. These improvements translate into fewer premature deaths, with annual public health benefits valued at approximately $ 80 million. While carbon intensity reductions deliver most of the climate benefits, the program also meaningfully reduces disparities in exposure to traffic-related pollution, particularly for communities of color and lower-income households, thereby improving both environmental and health equity.

Key Insights

- **Particulate Matter & Carbon:** PM2.5 concentrations fall by up to 20%, with primary reductions linked to on-road diesel and gasoline engines. Carbon emissions are cut significantly, especially in the CFP MAX scenario. There is a substantial reduction in carbon emissions, particularly under the CFP MAX scenario.
- **Other Pollutants:** NOx emissions decrease by 6–22%, further reducing secondary PM formation and ozone-related health burdens.
- **Health Benefits:** The program avoids about five premature deaths per million people annually and reduces exposure disparities by up to 20% in some communities, producing $80M/year in public health savings.
- **Environmental Justice Impact:** Oregon's Clean Fuels Program not only reduces greenhouse gases but also cuts particulate matter and NOx emissions, delivering measurable health gains and reducing disparities in pollution exposure across vulnerable communities.

Table 10: Oregon Clean Fuels Program: Pollution & Health Benefits

Pollutant / Benefit	Reduction / Impact
PM2.5	↓ up to 20%
Carbon (CO_2)	↓ Millions of tons by 2035
NO_x	↓ 6–22%
Other PM (EC, OC, UFP)	↓ 5–15%
Budget & Health Benefits	↓Budget ≈ **$80M/year savings** ↓Deaths **~20 fewer premature deaths** *(5/million people)*

Maryland’s Economic Challenges and Opportunities to Benefit from Increasing the Use of Biofuels

Maryland is entering 2025 under significant financial strain. The state faces a projected $3.3 billion budget deficit, the first downgrade of its AAA bond rating in three decades, and one of the most expensive business climates in the nation. Rising energy costs—including projected increases of $250–$276 annually in residential electric bills—are squeezing households and businesses alike. Meanwhile, the state's heavy dependence on federal jobs and spending leaves Maryland vulnerable to workforce reductions and contracting slowdowns, which threaten private-sector GDP and tax revenues.

At the same time, agriculture—one of Maryland’s most prominent commercial industries, employing over 350,000 people and contributing $8.25B annually—is under pressure from declining farmland, price volatility, and global trade risks. Without stable markets, farmers struggle to maintain profitability and preserve land for future food and fuel production.

Biofuels directly address both economic and climate challenges. By creating new demand for corn and soybeans, biofuels stabilize farm income, preserve farmland values, and generate added state tax revenue. Expanded ethanol and biodiesel blending reduces fuel costs for Maryland drivers and businesses, while building in-state processing capacity adds billions in economic activity. Just as importantly, these carbon reductions support compliance with the Climate Solutions Now Act (CSNA), which requires a 60% reduction in GHG emissions by 2031. Biofuels, therefore, provide a pathway for Maryland to strengthen its economy, stabilize its agricultural base, and achieve its climate and energy security goals simultaneously.

At-a-Glance: Economic Benefits of Biofuels for Maryland

- **Lower Consumer Costs:** Expanding ethanol and biodiesel use can reduce pump prices by $0.20–$0.40 per gallon, saving Maryland drivers $569M–$1B annually.
- **Increased State Revenue:** New biofuel demand generates an estimated $60M annually in state tax receipts, supporting budget stability.
- **Farmland Value & Farm Income**: Added demand for corn and soy stabilizes commodity prices, sustains farmland values, and prevents conversion to high-carbon commercial uses.
- **Total Economic Activity**: The combined impact of processing, consumer savings, and supply chain effects equals nearly $4.7 billion in annual economic activity and consumer savings.

Increasing Biofuel Can Serve as a Pillar of Economic Security

Investing in biodiesel production enhances Marland’s economic security by:

- **Preserving Agricultural Assets:** Protects working farmland from development pressures, maintaining domestic food and fuel capacity.

- **Stabilizing Food & Fuel Prices:** Diversifies fuel sources, reducing volatility in consumer prices and food supply chains.
- **Lowering Public Health Costs:** Reduces particulate matter and toxic air emissions, decreasing respiratory illness and related healthcare spending.
- **Mitigating Disaster & Infrastructure Risks:** Cuts greenhouse gas emissions and local pollution, potentially lowering property damage from climate-related events.
- **Strengthening Domestic Energy Resilience:** Ensures stable reserves of liquid fuels for agriculture, transportation, and emergency response, reducing reliance on global markets.
- **Enhancing Market Competition:** Increases fuel supply diversity, helping lower fuel costs for consumers and small businesses.
- **Reducing Geopolitical Exposure:** Lessens vulnerability to oil price shocks and energy supply manipulation by adversarial nations.
- **Summary:** Increasing the use and production of biofuel is more than an energy policy—it's a high-leverage tool to protect the U.S. and Maryland economies from systemic risks, ensuring long-term resilience and competitiveness.

Maryland's Energy Security Challenges & Opportunities to Benefit from Biofuels

Biofuel Production Enhances Energy Security and Economic Security

Maryland faces significant energy security vulnerabilities due to its complete reliance on imported liquid fuels and electricity. The state produces no crude oil, gasoline, or alternative fuels, and it does not maintain a strategic liquid fuel reserve. Disruptions—whether from international conflicts, refinery or pipeline failures, or cyberattacks, such as the 2021 Colonial Pipeline incident—can quickly ripple across Maryland, affecting federal agencies, military installations, ports, and the state's economy. Compounding the challenge, Maryland imports about 40% of its electricity, much of it generated from coal and natural gas outside the state, while growing demand from data centers and EV charging further strains supply. Expanding in-state biofuel production and use would help diversify supply, reduce dependence on vulnerable infrastructure, and improve resilience against both market shocks and security threats.

Key Problems & Biofuel *Solutions*

- Problem: Complete Dependence on Imported Fuels
  Solution: Develop local biofuel capacity (ethanol, biodiesel, renewable diesel) to reduce reliance on out-of-state supply chains vulnerable to disruption.
- Problem: Vulnerability to Cyber and Infrastructure Attacks
  Solution: Distributed biofuel production and storage enhance resilience, providing backup supply options when pipelines or utilities are compromised.

- Problem: Heavy Reliance on Coal-Generated Imported Electricity
  Solution: Deploy higher biofuel blends in existing vehicles and fleets to immediately reduce emissions, thereby alleviating pressure on the electric grid while providing a cleaner liquid fuel option.

Maryland's National Security Challenges & Opportunities to Benefit from Biofuels

National Security Risks of Oil Dependence and Implications for Maryland

Reliance on crude oil for transportation impacts Maryland's economic and energy security, and the nation's energy security challenges directly tie the state's energy security to the nation's dependence on imported oil. With no in-state production, refining capacity, or liquid fuel reserves, Maryland is situated at the end of the supply chain and is highly vulnerable to disruptions.

Cyberattacks, such as the 2021 Colonial Pipeline shutdown, geopolitical instability in OPEC+ regions, or refinery outages thousands of miles away, can immediately impact Maryland's fuel supply. These risks are magnified by the state's concentration of critical national security assets, including military bases, Coast Guard and National Guard facilities, federal agencies such as DHS, TSA, FEMA, and the Secret Service, and major ports and airports. In a crisis, emergency fuel would be prioritized for national defense and homeland security operations, leaving state agencies, first responders, and residents vulnerable to shortages and price shocks.

Expanding biofuel adoption—supported by 21B gallons of U.S. annual production—would reduce reliance on unstable foreign oil, strengthen resilience against supply shocks, and provide a cleaner, domestic "strategic reserve" that enhances both national and state security.

Key Insights from Maryland's National Security Challenges

1. Maryland's Energy Vulnerability

- No crude oil production, refining capacity, or liquid fuel reserves.
- Entirely dependent on imports, making the state highly sensitive to disruptions.

2. National Security Context

- OPEC controls ~80% of global oil reserves; OPEC+ (including Russia) controls 70–76%.
- The U.S. still sends ~$59B annually to OPEC, reinforcing dependence on unstable regions.
- Every U.S. president since FDR has tied Middle Eastern oil to U.S. national security commitments.

3. Local Strategic Risks

- Maryland hosts DHS, TSA, FEMA, Secret Service, Coast Guard, National Guard, and major military bases.

- In emergencies, federal and defense priorities would receive fuel first, leaving state responders and residents at risk.
- The 2021 Colonial Pipeline attack showed Maryland's vulnerability, with 34% of gas stations running out of fuel.

4. Biofuels as a Strategic Reserve

- U.S. biofuel production (21 BGPY) is three times larger than the Strategic Petroleum Reserve.
- Distributed biofuel capacity is less vulnerable to geopolitical shocks and cyberattacks.
- Expanded biofuel use would diversify Maryland's supply, support emergency response, and reduce exposure to OPEC+ manipulation.

Impact and Perspective

- By embedding biofuels into its energy and security planning, Maryland can align state resilience with national defense priorities. Biofuels not only reduce emissions and consumer costs but also serve as a domestic safeguard against global oil volatility, thereby strengthening Maryland's economy, protecting its residents, and securing the homeland.

Maryland's Environmental Security Challenges & Opportunities to Benefit from Biofuels

Maryland faces mounting environmental security challenges that carry direct economic consequences. The Climate Solutions Now Act (CSNA) requires a 60% reduction in carbon emissions by 2031, yet the state's largest emitting sector—transportation—still produces 82% of on-road GHG emissions. Without additional action, the Maryland Department of the Environment (MDE) estimates that the state could face $135 billion in climate-related damage from flooding, sea-level rise, and storm impacts. These threats are compounded by Maryland's $3B budget deficit and recent federal policy uncertainty, which make cost-effective climate solutions urgent.

Adding to the challenge, farmland loss accelerates emissions: Maryland lost over 12,000 acres between 2017 and 2022, reducing natural carbon sinks while fueling development with higher carbon intensity. If U.S. biofuel production declines, the "double-whipsaw" effect occurs, and farmland at home is converted to high-emitting commercial use. At the same time, global demand is met by imports from countries such as Brazil, Argentina, and China, where farming has a higher carbon intensity and greater deforestation risks. This creates a scenario in which emissions rise twice—once domestically and again globally.

Biofuels provide a direct path forward. By displacing petroleum, they immediately reduce transportation emissions, preserve farmland as a critical carbon sink, and counter outdated "indirect land use change" (ILUC) penalties. Instead of penalizing biofuels, evidence suggests they support sustainable agriculture by maintaining the value of farmland, incentivizing climate-smart practices, and preserving soils in production. Importantly, federal and state regulations—and Canada's Clean Fuel Regulation—are now recognizing the contribution of biofuels to agriculture by lowering or eliminating land use penalties. This shift reflects a growing consensus that biofuels are part of the climate solution, not a liability.

Expanding biofuel blending is therefore both a climate and an economic resilience strategy for Maryland, linking reduced carbon intensity with stronger farm economies and greater energy security.

At-a-Glance: How Biofuels Help Maryland Meet Environmental Security Challenges

- Carbon Reductions Now – Ethanol cuts emissions ~50% vs. gasoline; biodiesel/renewable diesel reduces 40–86% depending on feedstock.
- Farmland Preservation – Biofuel demand sustains farm income, keeping farmland in production and avoiding high-carbon development.
- Climate Cost Avoidance – Expanding biofuel use supports CSNA targets and helps Maryland avoid $135B in projected climate damages.
- Double-Whipsaw Prevention – Sustaining U.S. biofuel output avoids both domestic land commercialization and replacement imports with higher carbon intensity.
- Policy Momentum – Federal, state, and Canadian regulators increasingly credit biofuels' agricultural and carbon benefits, reducing or removing ILUC penalties.
- Economic Alignment – Biofuels deliver climate benefits while generating farm revenue, consumer fuel savings, and state tax receipts—helping close budget gaps.

Climate Change effects from carbon emissions

- "Farmers would have to plant an additional 5M acres of corn and 15M acres of soybeans to make up for the loss of high-protein co-products used to increase the efficiency of feeding animals." - **Transportation Energy Institute, 2024**

Maryland's Food Security Challenges & the Opportunity to Benefit from Biofuels

Biofuels as a Foundation for Food Security: Sustaining Farmland, Prices, and Resilience

Maryland's food security challenges are closely tied to preserving farmland and sustaining the value of agricultural production. While U.S. farmers have historically achieved more with less land, Maryland has lost over 12,000 acres of farmland between 2017 and 2022, accelerating the risk of weakened local food systems and higher long-term prices. Agriculture remains one of Maryland's largest industries, employing over 350,000 people and contributing approximately $8.25 billion annually to the state's economy. Corn and soybeans, the backbone of both food and biofuel production, are central to the resilience of this system.

Biofuels provide the demand needed to keep farmland in production. Ethanol now consumes approximately 40% of U.S. corn, helping to stabilize prices even in years of high yields. Biodiesel and renewable diesel have driven a 300% increase in soybean oil demand over the past decade, resulting in higher soybean prices and sustained farm income. Research shows that biofuel plants increase local farmland values by roughly 4% for every 100M gallons of capacity, anchoring farmland against development pressures. In Maryland, this demand has real consequences:

- A 14% drop in corn prices would cost Maryland farmers $34–$60M per year in lost income.
- A 13% drop in soybean prices would cost Maryland soybean farmers $26–$41M annually.

By creating new markets, biofuels expand the supply of food, feed, and fuel together. Preserving farmland means more productive land remains in agriculture rather than shifting to high-carbon commercial or residential development. Just as adding ethanol and biodiesel to the fuel supply reduces consumer fuel prices and strengthens energy security, biofuels help maintain a balance between food and feed prices, ensuring resilience in the face of climate change, global trade disputes, or geopolitical instability.

Key Insights: How Biofuels Support Food Security

Stabilizing Farm Prices and Land Values

- Ethanol and biodiesel demand sustains crop prices, preventing destabilizing swings.
- Stable prices are capitalized into farmland values, reducing conversion to development.
- Losses avoided: Maryland corn farmers save up to $59M annually, soybean farmers up to $41M annually from biofuel-driven demand.

Expanding Food and Feed Supply

- Reliable biofuel markets allow farmers to absorb rising yields from improved productivity.
- Preserved farmland means more food, feed, and fuel in the supply chain, keeping prices in balance.
- Prevents farmland loss that would otherwise reduce supply resilience and increase emissions.

Energy and Food Security Are Interdependent

- Biofuels reduce dependence on imported oil while creating steady farm demand.
- Stable farm economies enable investment in sustainable practices like no-till, cover crops, and precision agriculture.
- A resilient food-energy system strengthens Maryland’s economic security overall.

Food Security as a Top Priority

- There are alternatives to fossil fuels, but no alternatives to food.
- Biofuels help ensure long-term affordability and availability of food and animal feed.
- Preserving farmland through biofuel demand directly links to protecting household security and national stability.
- Loss of farmland due to conversion to commercial and industrial uses increases carbon emissions

Food vs Fuel vs Indirect Land Loss vs Direct Loss of Farmland

- Farmers planted an average of 322M acres per year (MMAPY) before the RFS and 318 MMAPY today. [19]
- From 2000 to 2023, farmland in the U.S. decreased by 66M acres. [20]
- From 2017 to 2022, Maryland lost over 12,000 acres of farmland. [21]
- The number of farms in the U.S. has decreased by 310,000 since the passage of the RFS (USDA/ERS, 2024).
- Between 2001 and 2016, 11M acres of U.S. farmland were converted to urban and commercial development—about 2,000 acres per day.

Impact: Farmland loss increases carbon emissions and creates an opportunity for other countries to fill the void, potentially leading to unsustainable agricultural practices.

Context & Perspective

The debate over "food vs. fuel" and indirect land use change (ILUC) often overlooks a simple truth: U.S. farmland use has remained essentially unchanged. In contrast, the fundamental drivers of land loss are development, lawns, and leisure spaces. To understand the issue, it's essential to compare the number of acres dedicated to productive farming with the number lost to non-agricultural uses.

Context: Farmers plant about 318 million acres today, only slightly less than the 322 million acres before the Renewable Fuel Standard. By contrast, the U.S. has 45 million acres of lawns, 2.2 million acres of golf courses, and up to 99 million acres of urban green space—all of which dwarf the 20 million acres of corn used for ethanol. Meanwhile, 83 million acres of soybeans supply both food and fuel markets.

Perspective: Indirect land-use penalties assume that U.S. biofuels push farming onto sensitive lands abroad; yet the reality is that farmland is being lost at home to urban sprawl and recreation. If we don't address this imbalance, the void will be filled by less sustainable producers overseas. That's why a public education campaign is essential—to ensure policymakers and the public compare apples to apples, not apples to AstroTurf. Biofuel detractors say ethanol cropland steals land from food, but if lawns were a "crop," they'd be the largest irrigated crop in America. In other words, your front yard grass is using more land than the corn in your gas tank—yet no one is lobbying for a "Lawn Use Change" penalty.

Outcome and Impact

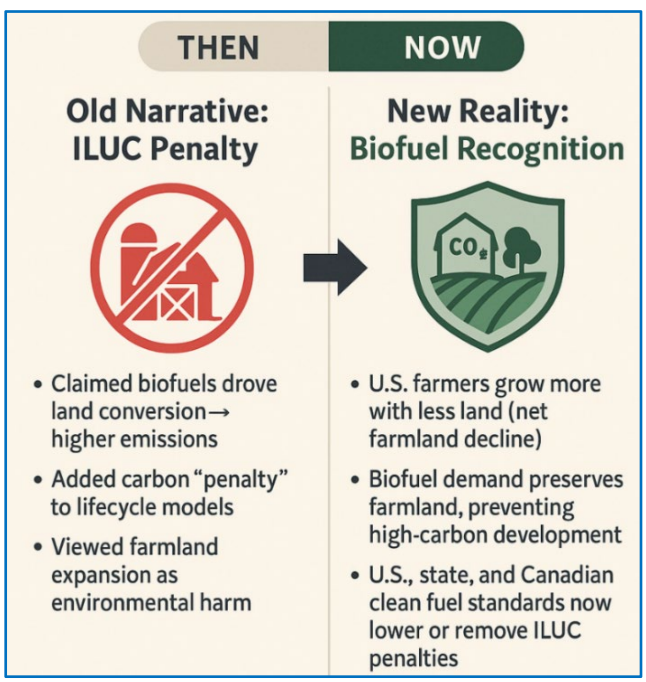
1. **Carbon Emissions:** Losing farmland to development **increases emissions** (construction, paving, transport needs) while reducing the land's carbon sink capacity.

2. **Global Leakage:** U.S. farmland loss creates a production gap that gets filled by countries with less sustainable practices—meaning deforestation abroad, higher global emissions, and the very "indirect land use change" (ILUC) critics warn about.

3. **Perspective:** While critics blame ethanol and biodiesel for hypothetical ILUC, the direct, measurable land loss is happening because of commercialization, urban and suburban growth, golf courses, and lawns—not because farmers are planting corn or soybeans. If our nation's policies can't have an impact on countries producing or consuming fossil fuels, how do we expect our policies to affect their ability to feed their own people?

4. **Impact:** The food vs. fuel debate ignores the reality that:
    - Biofuel crops come from existing farmland.
    - The real "competition" for land is between farms vs. development, lawns, and leisure uses.
    - Protecting farmland for food *and* fuel delivers carbon, security, and economic benefits.
    - The nation has made significant progress in producing alternative fuels but has yet to discover alternative foods.

Figure 3: The World Wasn't Flat and Smoking Wasn't Cool: Take Another Look at Biofuels



Maryland’s Personal Security Challenges & the Opportunity to Benefit from Biofuels

Cleaner Air and Safer Lives – How Biofuels Enhance Personal and Energy Security

Air pollution from petroleum fuels poses a direct threat to the personal security of every Marylander. Mobile-source air toxics—benzene, toluene, xylene, and fine particulate matter (PM2.5)—drive higher rates of asthma, cardiovascular disease, and premature deaths, with health and insurance costs passed on to families and businesses. In Maryland, hotspots like Baltimore and Prince George’s County bear disproportionate burdens, with asthma hospitalization rates more than double the state average.

Studies show that a 1% rise in particulate pollution leads to an 11% increase in individual commercial health insurance expenditures. Cleaner-burning biofuels displace these toxics, cutting emissions and health costs. California’s Low Carbon Fuel Standard has already saved residents over $10B in avoided health and economic damage, preventing thousands of asthma attacks, heart attacks, and premature deaths.

Expanding biofuel use in Maryland would replicate these benefits—while also reducing dependence on foreign oil, which fuels Middle Eastern conflicts, terrorism, and the national security risks that threaten Americans abroad and at home.

Key Insights: Maryland’s Personal Security Challenges

1. **Pollution and Health Costs**
    - PM2.5 exposure in Baltimore is 37% above the state average; diesel pollution in Prince George’s is 23% above average.
    - Pollution drives higher ER visits, hospitalizations, and premiums.
    - Each 1% increase in PM2.5 = 11% increase in commercial health insurance costs.
2. **Personal Security Risks**
    - Pollution causes 130 deaths per 100,000 residents annually in Baltimore—the highest in the U.S.
    - Black children account for 88% of pediatric asthma hospitalizations tied to traffic pollution.
    - Older adults face elevated risks, with PM2.5 contributing to ~50% of pollution-related Medicare costs.
3. **Lessons from California**
    - LCFS reduced carbon fuel intensity by ~13% and displaced 70% of diesel use.

- Over $10B in avoided health and societal costs by 2020.
- Prevented 38,000 asthma attacks, 600 heart attacks, and nearly 900 premature deaths.

4. Maryland's Missed Opportunities

- No LCFS or biofuel incentives in place; major climate laws exclude ethanol entirely.
- Without policy change, Maryland forfeits billions in potential health and economic savings.
- Communities already facing environmental justice burdens will remain disproportionately harmed.

5. National Security Connection

- The U.S. sends ~$59B annually to OPEC, indirectly funding conflict and terrorism.
- Presidents from Roosevelt to Biden have linked oil dependence to military commitments in the Middle East.
- Reducing reliance on Petrodollars through biofuels enhances both personal and national security.

Challenges for Biofuel Stakeholders

Like the state, Maryland biofuel stakeholders must address challenges related to industries when assessing the impacts and opportunities to increase biofuel production and use in the state.

Combined Key Insights from Ethanol & Biodiesel Stakeholder Feedback

1. **Policy and Regulatory Uncertainty:** Uncertainty at both the federal and state levels emerged as the most critical barrier. Stakeholders cited inconsistent Renewable Fuel Standard (RFS) volume obligations, frequent small refinery exemptions, unclear EPA rulings (e.g., E15 waiver), and shifting tax credit rules. At the state level, insufficient or absent Low Carbon Fuel Standards, inadequate incentives, and penalties, such as indirect land-use change (ILUC) factors, were identified as major deterrents to investment and market growth.

2. **Feedstock Challenges:** Volatility in feedstock availability and pricing—compounded by carbon intensity regulations and limited financial support for farmers—was consistently ranked as the top constraint. Concerns extended to the need for Climate Smart Agriculture standards and resilience against global supply pressures.

3. **Public Education & Awareness:** A lack of understanding among consumers, policymakers, and fleet administrators undermines confidence and slows adoption.

Stakeholders recommended robust outreach and education campaigns to build demand and strengthen acceptance.

4. **Infrastructure Barriers:** Limited infrastructure for distributing and using higher ethanol and biodiesel blends—particularly for government and commercial fleets remains a significant obstacle. Stakeholders emphasized the need for blending incentives, expanded fueling sites, and greater manufacturer support for high-blend vehicles.

5. **Market Dynamics & Volatility:** Ethanol and biodiesel producers face narrow margins and vulnerability to subsidized fossil fuel competition. Regulatory instability and fluctuating carbon credit values create additional risk, undermining plant viability and deterring long-term investment.

6. **Technology and Vehicle Issues:** Stakeholders called for improved production efficiency, yield, and lifecycle certification, as well as investment in next-generation biofuels and carbon management. Concerns were raised over manufacturer support for high-biodiesel blends, cold-weather performance, and the need to restore flex-fuel vehicle incentives and encourage engine optimization for higher biofuel blends.

7. **Global Competition:** Imports, shifting international policies, and the absence of unified global sustainability standards were flagged as significant threats to domestic supply, competitiveness, and long-term sector expansion.

Legislative and Regulatory Challenges in Maryland

1. Legislative Gaps

- No Low Carbon Fuel Standard (LCFS) or biofuel incentive program exists.
- Major state climate policies (CSNA 2022, Climate Pollution Reduction Plan, Transportation Plan, Renewable Portfolio Standard) omit ethanol and provide no implementation pathway for biofuels.
- Reports from commissions and agencies (Environmental Justice, Buy Clean, Energy Assurance, MDOT GHG Plan) do not reference biofuels as a solution.

2. Regulatory Barriers: GHG Accounting

- Maryland relies on EPA's MOVES model, which counts only tailpipe CO_2, CH_4, and N_2O emissions.
- MOVES excludes upstream emissions (extraction, refining, power generation) and lifecycle benefits of biofuels.
- MOVES favors EV adoption on paper while undervaluing biofuels' well-to-wheels benefits.

3. Policy Gap: Market Utilization

- No requirement or incentive exists for higher biofuel blends in ICE, hybrid, plug-in, or diesel vehicles.
- Retailers lack financial motivation to invest in E15/E85 or higher biodiesel blends without LCFS-like crediting.

4. Comparative Case Study

- California (2011), Oregon (2016), Washington (2023), and Canada (2023) operate LCFS programs where biofuels provide ~80% of carbon credits.
- California's 2026 legislation now allows E15 blending, expanding ethanol's role in its LCFS market.
- These programs contrast sharply with Maryland's lack of adoption or planning for biofuel pathways.

5. Implications

- Maryland risks missing near-term, low-cost carbon reductions from existing fleets.
- Farmers, retailers, and consumers lose economic and environmental benefits from higher biofuel use.
- Without policy changes, Maryland's clean fuel strategy will remain incomplete and less equitable compared to other states.

U.S. EPA E15 Waiver

EPA's current Reid Vapor Pressure (RVP) volatility standard prohibits gasoline marketers from offering year-round sales of E15 (15% ethanol, 88-octane) in most regions. Although EPA approved E15 for use in 2001 and newer vehicles (covering 97% of U.S. gasoline consumption), sales remain restricted to summer blends unless temporary waivers are issued. This limits consumer access, undermines ethanol demand, and constrains market growth for a lower-priced, higher-octane, lower-emission fuel.

- **Impact on Ethanol Sales:** Without a permanent legislative fix, retailers are discouraged from investing in E15 infrastructure, and consumers are denied consistent access to the fuel. Studies—including a 2025 CARB analysis—show E15 reduces particulate matter, carbon monoxide, BTEX aromatics, non-methane hydrocarbons, and greenhouse gases. Nationwide adoption could increase biofuel use by as much as 50%, providing stability for rural economies and farmland preservation.

- **Why Aromatics Matter More than RVP:** For decades, EPA's focus on reducing volatility (RVP) has had diminishing returns as new vehicle technology and refueling systems already control evaporative emissions. Meanwhile, aromatic hydrocarbons (benzene, toluene, xylene) remain the dominant source of toxic tailpipe emissions, secondary particulates, and urban smog precursors. Reducing aromatic content through higher ethanol blends would deliver far greater health and climate benefits than further tightening vapor pressure standards—while simultaneously supporting domestic fuel production and consumer choice.

- **Legislative Pathway – Case Study: NCFRC Act:** The Nationwide Consumer and Fuel Retailer Choice Act, first introduced in 2015 and reintroduced multiple times since, aims to provide a permanent, uniform solution by extending the RVP waiver to E15. The 2025 version passed the House with bipartisan support (220–208), backed by farm groups, retailers, and even the oil industry, though some environmental advocates remain opposed.

Poor Consumer Perception and Lack of Public Education

The United States is the world's largest gasoline market, consuming more gasoline than any other country and accounting for nearly 35% of global gasoline usage. US consumption is almost three times that of China, the next largest market, reflecting its high rates of car ownership, extensive transportation infrastructure, and economic reliance on conventional fuels.[22]

Consumer perception and a persistent lack of public education have critically undermined the acceptance and advancement of biofuels, particularly ethanol, for decades. This challenge is exacerbated by coordinated misinformation campaigns, such as the 2008 example when Senator Grassley revealed a $300,000 anti-ethanol smear campaign funded by the Grocery Manufacturers Association, which leveraged environmental and hunger groups to manipulate public opinion through a strategic RFP process. These efforts, coupled with widespread myths—like claims that ethanol ruins engines or drives up food prices—have successfully sown confusion and distrust, often outpacing factual information about ethanol's environmental and economic benefits. Federal agencies have launched robust educational efforts needed to counteract this, leaving most Americans unaware of basic gasoline components (like BTEX or benzene) and the advantages of renewable biofuels. This sustained deficit in public awareness and fact-based outreach enables fossil fuel interests to maintain market dominance and slow the transition to safer, cleaner alternatives.[23]

The perpetuation of myths about biofuels in the struggle for control of the US gasoline market resembles an ongoing saga, akin to Star Wars or Car Wars, where entrenched interests fight to maintain dominance through disinformation and rhetorical tactics. Notably, these myths rarely provide meaningful comparisons to other critical societal problems—such as the transition away from leaded gasoline, public health campaigns against tobacco, the rise of seatbelt laws, or solutions like nicotine gum for smokers—where competition and innovation have led to safer, healthier standards for all. Instead, anti-ethanol campaigns often ignore the progress and benefits that result from challenging outdated practices and embracing alternatives, framing ethanol solely in terms of idealized perfection rather than real-world improvement over conventional fuels.

Maryland Biofuels Task Force Consumer Awareness Survey

Maryland consumers surveyed in the 2025 Biofuels Task Force Study showed a lack of awareness of key biofuels benefits, with the majority expressing unfamiliarity and indifference to the economic, environmental, and health impacts of increased biofuels use. Most respondents were not previously aware of topics such as price savings, carbon reductions, and supply chain benefits from biofuel policies, and many remained unconcerned even after being educated through survey questions.

Key Findings: Areas Consumers Did Not Know or Did Not Care About

Across all sections, 60–90% of respondents indicated they were not aware of the benefits of biofuels before taking the survey.

- For economic topics like fuel price savings from E15, as ~85% were previously unaware, and some indicated apathy after learning about it.
- None of the respondents were previously aware that biomass-diesel production contributed to lower diesel prices; all indicated a lack of prior knowledge, and some showed indifference.
- The vast majority, 80–90% lacked prior awareness regarding farmland value, carbon emission reductions, and food security benefits of biofuels.
- On health impacts (like avoided asthma symptoms and healthcare costs), almost all respondents were unaware..
- Even environmental facts (e.g., biofuels' lower carbon intensity and air pollution reductions) saw 75–90% "not aware" rates, with a fraction continuing to "not care" post-survey.
- Overall, the survey revealed a significant consumer knowledge gap and some persistent indifference regarding biofuels' multi-sector impacts, which could present challenges for policy adoption and education efforts.

Combating Misinformation: Top Ten Major Myths About Biofuels

1. **Biofuels Increase Greenhouse Gases: *False***

Ethanol has about 50% less carbon than gasoline. [24] [25] Biodiesel and renewable diesel reduce carbon emissions by 40% to 69% when produced from soybean, canola, and carinata oils, and 79% to 86% when converting tallow, used cooking oil, and distillers' corn oil. [26]

The current U.S. DOE GREET model confirms that biodiesel, especially when made from waste oils, achieves significant emissions cuts (40–86%) compared to conventional diesel, supporting its use as a low-carbon transportation fuel under U.S. policy.

2. **"Food versus Fuel," i.e., reducing food production: *False***

Since the establishment of the renewable fuel standard, the U.S. agriculture sector has produced more fuel, food, and animal feed on less land. U.S. biofuel plants produce 21 BGPY of low-carbon fuel and 350MMT tons of high-protein feed.

Table 11: U.S. High-Protein Feed Production (Pre-RFS 2005 vs.2024)

Year	DDGS *(Ethanol Co-product)*[27] [28]	Soybean Meal *(Biodiesel/Crush Co-product)*[29]	Estimated Combined Total
2005	9MMT [30]	~40MMT *	**~ 50MMT**
2024	36MMT[31]	~ 260MMT[32]	**~ 300MMT**

Table 12: U.S. Corn and Soybean Production and Acres Planted (Pre-RFS 2005 vs.2024)

Crop	Year	Acers Planted (M Acres)	Production (B bu.)	Production (MMT)*
Corn	2005	81.6	11.95	**~ 303.7**
	2024	91.5	15.1	**~ 383.5**
Soybeans	2005	72.1	2.79	**~ 76.0**
	2024	87.1	4.37	**~ 119.0**

Notes: *U.S. production of biodiesel was negligible—1 bushel of corn ≈ , 25.4 kg; 1 bushel of soybeans ≈ , 27.2 kg.

3. **Ethanol Increases Land Use: *False***

Since 2005, the United States has lost approximately 24 million acres of farmland, resulting in a total decline from approximately 900 million acres in 2005 to approximately 876 million acres in 2024. Most of the loss was attributed to development, conversion to other uses, and, in particular, a significant reduction in pastureland rather than cropland. However, cropland also declined by several million acres over the same period.[33]

Table 13 shows that while total U.S. farmland declined from ~938 million acres in 2005 to 880 million acres in 2024, the number of effective planted acres actually increased from around 283 million to 310 million acres. This apparent paradox is explained by fewer acres in the Conservation Reserve Program (CRP), fewer prevented planting acres in 2024, and farmers reallocating existing cropland toward high-demand crops like corn and soybeans. In other words, the U.S. is farming more intensively on a shrinking farmland base, not converting non-farmland into cropland.

Impact from the loss of biofuel production: If biofuel detractors were to shut down ethanol plants, farmers would need to plant an additional 5 million acres of corn and 15 million acres of soybeans to compensate for the loss of high-protein co-products used to increase the efficiency of animal feed (Transportation Energy Institute, 2024).

Table 13: U.S. Farmland vs. Planted Acres (Pre-RFS 2005 vs. 2024)

Year	Total Farmland All Uses *(Cropland + Pasture + Rangeland, Million (M) acres)*	Total Crop Acres *(M)*	CRP Acres *(M)*	Prevented Planting Acres *(M)*	Effective Planted Acres *(M)*
2005	~938	~320	~35	~2	≈ 283
2024	~880	~338	~24	~4	≈ 310

Notes and Sources for Table 11 above: *U.S. Farmland vs. Planted Acres (Pre-RFS 2005 vs. 2024) Data compiled from U.S. Department of Agriculture, National Agricultural Statistics Service (2007 and 2022 Censuses of Agriculture; Acreage Report, June 30, 2005), U.S. Department of Agriculture, Farm Service Agency (CRP Monthly Summary; Prevented Planting Acreage Reports, 2005 and 2024), and Scott Irwin, "Estimating Total Crop Acres for the U.S. over 1998–2025," Farmdoc Daily (15):64, April 3, 2025.*

4. **Biofuels will increase the price of gasoline and diesel fuel:** *False.*

The following summarizes recent studies indicating that adding biofuel to the motor fuel supply is beneficial and provides consumers with savings.

- E15 (15% ethanol blend) is consistently cheaper than E10 (10% ethanol blend) at the pump. Recent studies and industry reports show that E15 typically saves consumers between 10 and 30 cents per gallon compared to E10, with some locations reporting savings of up to $1 per gallon during specific periods. Nationwide, these savings add up. If the U.S. were to switch from E10 to E15 as the standard fuel, consumers could save over $20B annually in fuel costs.
- A Fuels Institute study shows that biofuels are on track to achieve a 10% volume share by 2022. A 2022 report estimated that from 2010 to 2021, the global introduction of biomass-based diesel reduced #2 diesel prices by 8% to nearly 19% annually, depending on the year and supply levels. U.S. production alone contributed to a 1–4% reduction in diesel prices. Clean Cities Alternative Fuel Report: On average, during this reporting period, B20 cost $0.44 less per gallon than diesel. Clean Fuels Alliance America (CFAA) reports that U.S. production of biodiesel and renewable diesel has contributed to a 4% reduction in diesel fuel prices. On the national average, that translates to around **22 cents per gallon in savings**.

5. **Ethanol Use Is Mandated:** *False.*

The transition from leaded to unleaded gasoline, then to reformulated gasoline, and now to the renewable fuel standards was driven by regulations aimed at improving public health. Biofuels are the cheaper, better, faster, and safer products that meet those regulatory specifications.

6. **Ethanol Blends Increase Pollution:** *False.*

A California Air Resources Board (CARB) report from April 2025 states that increasing the amount of ethanol in gasoline from 10% to 15% (E10 to E15) results in significant reductions in particulate matter, carbon monoxide, total hydrocarbons, non-methane hydrocarbons, and carbon dioxide.

7. **Ethanol Harms Cars and Will Never Work on a Large Scale:** *False*

With 21 BPGY of production in 2024, U.S. biofuel production is three times larger than the U.S. Strategic Petroleum Reserve.

8. **The U.S. biofuels industry receives federal government subsidies:** *True with the perspective provided.*

Fossil fuel subsidy perspective[34]: Combined, removing supports and pricing externalities could add roughly $2.40–$3.50 per gallon to the "true" cost of gasoline. U.S. fossil fuels receive approximately $20 billion per year in direct subsidies, with broader taxpayer and societal support—including military protection of oil supplies—adding tens to hundreds of billions more, totaling roughly $760 billion annually when indirect costs, such as infrastructure and externalized environmental impacts, are included.

- Climate damages (CO_2 only): $51 to $190/Ton = $0.45–$1.69/gal. (U.S. EPA, Harvard Law)
- Air-pollution/public health damages ($PM_{2.5}$/O_3): $0.20 to >$1.00/gal (higher in dense urban areas). (*Environmental Research*)[35]
- Military protection of global oil supply: $11–$30 per barrel) 28-70 cents per gallon (S.A.F.E.)
- Direct federal subsidies ≈ $20B/yr. ≈ ~$0.10/gal. (U.S. DOE/EIA)

Ethanol: The Volumetric Ethanol Excise Tax Credit (VEETC), also known as the "blender's credit," was the last direct federal subsidy for fuel ethanol, which expired in 2011.[36] Tax Credits for Other Fuels: Although some tax incentives remain in place for biodiesel, renewable diesel, and sustainable aviation fuel (SAF), ethanol is excluded.[37] [38]

Biodiesel: Beginning January 1, 2025, and running through December 31, 2027, the new Clean Fuel Production Credit (§45Z) provides up to $1.00+ per gallon for fuels that achieve at least a 50% reduction in lifecycle greenhouse gas emissions compared to petroleum, and it applies on a technology-neutral basis.

9. **The Nation does not need a Renewable Fuel Standard:** *False.*

The claim that the U.S. no longer needs a Renewable Fuel Standard is misleading. Without the RFS, oil companies would have little incentive to blend biofuels, since fossil fuels benefit from artificially low prices driven by subsidies, externalized health and security costs, and entrenched infrastructure advantages. Eliminating the RFS would shrink demand for biofuels, stall new investment, and lock in barriers to market entry—ensuring that so-called "free market" competition remains tilted in favor of petroleum rather than allowing renewable fuels to compete fairly on cost, performance, and societal value.

Table 14: U.S. Biofuels Production (Pre-RFS 2005-2024)

Fuel Type	**Year**	**Production (M Gal.)**	**Increase (M Gal.)**
Ethanol	2005	3,904	—
	2024	16,220	**+12,316**
Biodiesel	2005	90.8	—
	2023*	1,699	**+1,608**
Renewable Diesel	2005	~0 (negligible)	—
	2022/23	2,300	**+2,300**
Total Biodiesel + Renewable Diesel	2005	~91	—
	2022/23	~4,000	**+3,909**

Source: U.S. Biofuels Production[39]

10. **Supporting biofuels is a waste of taxpayer money:** *False.*

If knowledgeable, most taxpayers might consider that biofuels contribute $78B in GDP and 470,000 jobs to be an investment in America's economy, national security, and public health. With over 250 facilities producing 21 billion gallons annually, the industry also contributes $35 billion in wages and provides $12 billion in tax revenues. Beyond economics, biofuels deliver more than 110MMT of high-protein feed, reduce dependence on volatile foreign oil markets, cut harmful emissions that improve public health, and strengthen both national and food security.

Unlike fossil fuels, which rely on hidden subsidies, biofuels provide transparent and measurable returns to society.

Table 15: Economic Impact of U.S. Biofuel and Feed Production & Economic

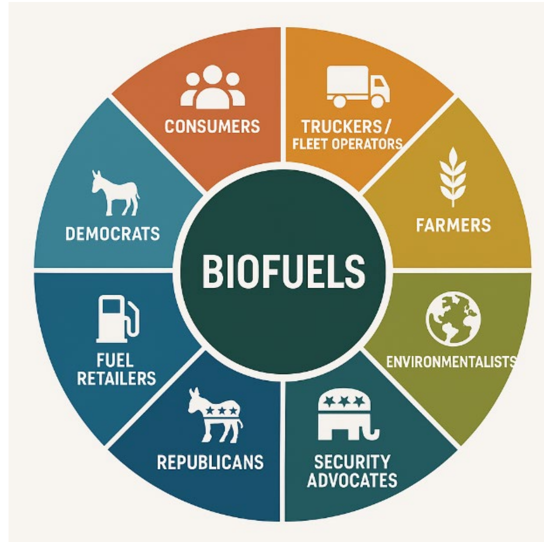
Metric	Biodiesel	Ethanol	Total
Number of U.S. Biofuel Facilities	56 in 25 states	200 in 23 states	**256 in 25 states**
Annual Production (B gal/year)	5BGPY	16BGPY	**21BGPY**
Co-products (MMT)	71MMT soybean meal, 1.6MMT glycerin	35MMT animal feed, 4.2B lbs. corn oil	**110+ MMT**
Industry Investment	$6B	30B	**$36B**
Economic Activity to GDP	$23B	$55B	**$78B**
Annual Wages Supported	$3.6B	$32B	**$35B**
Jobs Created	75,200	395,000	**470,000**
Support to Budgets (Federal/State/Local)	$2B	$10B	**$12B**

Table 16: Planted Corn Acreage and Production

Year	Planted Corn Acreage (M acres)	Corn Production (B bushels)	Corn Production (MMT)
2005 (Pre RFS)	81.6	11.95	**~ 303.7**
2024	91.5	15.1	**~ 383.5**

- Corn acreage increased by ~**10M acres** (+12%) and production increased from 11.95 to 15.1B bushels (+26%) between 2005 and 2024.
- Soybean acreage increased by ~**15M acres** (+21%) and production increased from 2.79 to 4.37B bushels (+57%).

Building A Larger Coalition of Supporters in Maryland



Maryland residents are strongly supportive of climate action. Still, most people are unaware of the immediate role biofuels can play in reducing emissions from every gallon of fuel used in existing cars, trucks, hybrids, and plug-in vehicles. Limited public education and persistent misconceptions have led to biofuels being underutilized and undervalued in the state's climate strategies. This gap underscores the need for a diverse and powerful coalition of supporters—including farmers, truckers, fuel retailers, environmental advocates, and policymakers across the political spectrum—to reframe biofuels as a practical, affordable, and complementary solution alongside EVs and other clean technologies. With strong coalition backing, Maryland can correct public perception, expand consumer choice, and secure biofuels' place as a central tool in decarbonization.

Key Insights of Building a Larger Coalition of Supporters in Maryland

1. Public Perception Challenges

Surveys show that 70% of U.S. consumers prefer sustainable products, but awareness of the benefits of biofuels is low.

Maryland's major climate policies do not prioritize biofuels, contributing to public neglect.

2. Maryland Public Opinion

Eighty % acknowledge that climate change is happening; 75% support state/local action.

Climate concern in Maryland exceeds the national average, yet biofuels are often missing from most discussions.

3. Broad Stakeholder Benefits

- Consumers: Lower pump prices and cleaner air.
- Farmers: Stable markets and rural economic growth.
- Fleet Operators: Fuel savings and cleaner supply.
- Environmentalists & Public Health Advocates: Reduced toxic emissions and GHGs.
- National Security Advocates: Less dependence on imported oil.

4. Lessons from Other Products and Market Sectors

Sectors like telecom, food, and energy demonstrate how monopoly conditions evolve into consumer-driven, competitive landscapes.

Fuels should be no exception—biofuels add choice, not replacement, alongside EVs and other clean technologies.

5. Missed Opportunities Without Support

Without coalition advocacy, Maryland risks sidelining biofuels in favor of slower or costlier strategies.

Fuel retailers lack market motivation without stronger public and political backing.

Recommendations for Building a Larger Coalition of Supporters in Maryland

1. **Build a Multi-Sector Coalition:** Unite farmers, fleet managers, retailers, defense and peace advocates, and bipartisan policymakers around the economic, environmental, and security benefits of biofuels.
2. **Launch Public Education Campaigns:** Highlight biofuels as a complementary clean fuel option, not a competitor to EVs. Stress health and consumer benefits.
3. **Integrate Biofuels into Climate Plans:** Advocate for explicit inclusion of higher blends in Maryland's Climate Solutions Now Act, Pollution Reduction Plan, and transportation strategies.
4. **Empower Retailers and Fleets:** Support programs and incentives for blending infrastructure and consumer choice at the pump.
5. **Frame Biofuels as Everyday Climate Action:** Reinforce the message that biofuels reduce emissions from *every vehicle, every gallon, every day*.

Report Research and Findings

Assessing Maryland's Economic, Energy, Environmental, Food, National, and Personal Security Challenges and the Benefits of Increasing the Use of Biofuels

Public support for addressing climate change in Maryland is high, with most residents acknowledging its existence and supporting government action. The Maryland Climate Solutions Now Act aims for significant emissions reductions by 2031 and net-zero emissions by 2045.

The order of issues presented in this report reflects how each benefit of biofuels builds upon the other, creating a layered foundation of security for Maryland and the nation. At the core, producing biofuels from Maryland's agricultural sector generates direct ***economic security*** benefits by adding value to farm products—converting crops into food, feed, and fuel while supporting rural communities. This value-added processing strengthens energy security by reducing reliance on imported petroleum and building a more resilient domestic supply.

The benefits of economic security flow into enhancing ***energy security***. Using biofuels reduces carbon emissions, improves air quality, and lowers the long-term costs and damages associated with climate change. Stronger energy security also yields ***national security*** benefits, reducing the strategic dependence on unstable foreign oil markets and diminishing the flow of Petro-dollars that have historically fueled conflict and terrorism. At the same time, biofuel production enhances ***food security*** by preserving the value of farmland, thereby preventing its conversion to commercial or industrial uses that would increase carbon emissions and weaken rural economies.

Ultimately, each of these "securities" converges to deliver ***personal security*** benefits—healthier air, fewer pollution-related illnesses, more stable fuel and food prices, and greater resilience for every Marylander. In conclusion, all of these outcomes ultimately contribute to regenerating the circular benefits of economic security.

Cleaner, lower-carbon fuels can save lives, preserve farmland, protect national interests, and lower costs for families, businesses, and government. The circular and cumulative effect is apparent: biofuels deliver broad, compounding returns across every sector—saving lives, farms, and money, one more gallon at a time—cheaper, better, faster, and safer than doing nothing.

Biofuels are more than a bridge fuel—they are a security asset. By producing and blending more renewable fuels, Maryland can simultaneously lower transportation carbon intensity, stabilize farmland values, create jobs, reduce consumer fuel costs, and avoid billions in climate damage. Every additional gallon delivers measurable benefits in terms of economic, energy, environmental, national, food, and personal security.

Section 1: Economic Security

Assessing Maryland's Energy Security Challenges and the Benefits of Increasing the Use of Biofuels

Biofuel production and use enhance Maryland's strategic resilience by simultaneously bolstering the state's economy, improving energy diversity, enhancing air quality and the environment, and safeguarding personal security through improved food security and health outcomes. Biofuels promote integrated security across the transportation, industrial, commercial, government, and public sectors.

Biofuels as a Pillar of U.S. Economic Security

Investing in biodiesel production enhances Marland's economic security by:

- **Preserving Agricultural Assets:** Protects working farmland from development pressures, maintaining domestic food and fuel capacity.
- **Stabilizing Food & Fuel Prices:** Diversifies fuel sources, reducing volatility in consumer prices and food supply chains.
- **Lowering Public Health Costs:** Reduces particulate matter and toxic air emissions, decreasing respiratory illness and related healthcare spending.
- **Mitigating Disaster & Infrastructure Risks:** Cuts greenhouse gas emissions and local pollution, potentially lowering property damage from climate-related events.
- **Strengthening Domestic Energy Resilience:** Ensures stable reserves of liquid fuels for agriculture, transportation, and emergency response, reducing reliance on global markets.
- **Enhancing Market Competition:** Increases fuel supply diversity, helping lower fuel costs for consumers and small businesses.
- **Reducing Geopolitical Exposure:** Lessens vulnerability to oil price shocks and energy supply manipulation by adversarial nations.

Impact: Increasing the use and production of biofuel is more than an energy policy—it's a high-leverage tool to protect the U.S. and Maryland economies from systemic risks, ensuring long-term resilience and competitiveness.

Overview of Maryland's Economic Challenges

Maryland faces several economic headwinds in 2025:

Budget Deficit: The state is grappling with a projected $3.3B deficit, leading to a downgrade of its AAA bond rating for the first time in over three decades. This downgrade is expected to increase borrowing costs for public projects, further straining state and local budgets. [40]

- Maryland faces more than $1B in combined structural and cash deficits this year. That gap more than doubles to $2.7B in fiscal 2026 and 2027. - Department of Legislative Services Budget Analyst. Maryland Matters, Nov. 12, 2024.

- “I commend Gov. Moore for putting economic growth front-and-center of his agenda to close the budget gap... we cannot simply tax or cut our way to prosperity — we must drive continued economic growth and prosperity.” - Calvin Ball, Howard County Executive. (Target News Service, January 16, 2025)
- "We only have difficult decisions ahead. We must close this $3 billion budget gap, and we have to do it in a way that grows the middle class, supercharges and diversifies our economy, breaks our distinct reliance on Washington, and helps Maryland seize its place in an uncertain world. We're Maryland. We step up. We stand tall. And we always, always answer the call in a moment of crisis – not with fear, but with determination." - Maryland Governor Wes Moore, 2025 State of the State, February 25, 2025
- Tariffs on agricultural products could significantly impact the budget deficit and the state’s largest commercial industry, which employs 350,000 people and contributes $8.25B annually to Maryland’s economy. The Penn Wharton Budget Model estimates that tariffs could reduce imports by over 29%, resulting in $8.1 trillion in losses from higher consumer and farm prices.[41]

Historically, every $10/barrel increase in oil prices adds 0.1–0.5% to annual inflation; $100 oil could push the CPI 0.5–1.5% higher in 2025–2026. [42] Dallas Fed Energy Survey reports that oil and gas activity in the Eleventh District increased in January 2025, with the oil production index rising to 5.0 and the natural gas production index climbing to 3.5. However, the outlook uncertainty index reached 29.2, the highest level in seven months, indicating rising uncertainty among energy executives.

According to Maryland’s Climate Pathway report, reducing GHG emissions in Maryland by 646 million metric tons of CO_2e between now and 2050 achieves a total societal benefit of $ 135 billion. [43] Maryland’s Climate Pollution Plan, “Even if fully implemented and maximum emissions reductions are achieved, these current policies only reach 51% reductions by 2031. Additional policies are therefore needed to meet the State target. [44] ”

In 2018, air pollution incurred a staggering $2.9 trillion in costs for the global economy, corresponding to 3.3% of the world's GDP. In the same year, unhealthy air quality resulted in 1.8 billion days of work absences worldwide. Other estimates suggest that air pollution accounts for USD 5 trillion, annually, in welfare costs for the global economy”. [45]

Electricity rates in Maryland are projected to rise significantly in 2025, with average residential bills increasing by approximately $250 to $276 per year, depending on the utility provider and region. [46] According to the National Rural Electric Cooperative Association, “Electricity demand is skyrocketing across America, and supply is not keeping pace.[47] Fearing strain on Maryland's already battered electric grid, lawmakers this session will look to decrease reliance on neighboring states.[48]

Business Climate: Maryland ranks 46th in overall state business tax climate, making it one of the least attractive environments for business investment. It is the third most expensive state to do business in, and its infrastructure ranking has dropped significantly to 37th nationally.[49]

Population and Migration: The state has experienced a net domestic out-migration, ranking 44th nationwide, indicating challenges in retaining residents and talent.[50]

Federal Dependency: Maryland's heavy reliance on federal jobs and spending exposes the state to outsized risks from federal budget cuts and workforce reductions.[51] [52]

Employment Growth: Maryland added 88,300 jobs from January 2023 to January 2025, representing a 3.2% increase that outpaced the national growth rate of 2.8%.[53] From September 2014 to September 2024, Maryland ranked 30th in total non-agricultural job growth, but only 39th in percentage job growth.[54]

Unemployment Rate: As of early 2025, Maryland's unemployment rate stands at 3.0%, well below the national average of 4.0%.[55] [56]

Job Sectors: Leading job gains have been in services, government, accommodation/food services, private education, and healthcare.[57]

Impact of Changes in Federal Government Policy

Job Losses: Maryland is projected to lose over 28,000 federal jobs due to workforce reductions, with contracting slowdowns threatening up to 10% of the state's private-sector GDP. [58]

Revenue Decline: Income tax revenue projections have been slashed by $350M across fiscal years 2025 and 2026, primarily due to federal job cuts. This compounds an existing $3B budget shortfall. [59]

Local Government Strain: Counties, heavily reliant on local income tax revenue, face cost shifts and may be forced to cut services or raise property taxes. [60]

Real Estate Impact: Reduced federal employment is expected to weaken home values and commercial real estate, shrinking the property tax base. [61]

Table 17: Largest Industries in Maryland and National Rankings

Industry	National Ranking/Status	Notes
Life Sciences	3rd in the U.S.[62]	Over 3,400 businesses, generating $20.7 billion in economic activity.[63]
Cybersecurity & IT	1st in cyber talent (DC region).[64 65]	Largest concentration of cyber professionals
Aerospace & Aviation	Major national hub. [66]	Strong commercial and defense presence
Quantum Computing	Emerging national leader.[67]	Major investments underway
Advanced Manufacturing	Competitive, growing sector.[68]	Focus on Industry 4.0 technologies.
Distribution & Logistics	Key East Coast location.[69]	The Port of Baltimore is a national leader in the maritime industry.
Food & Agribusiness	Significant, but not top 10.[70 71]	Major regional player

Role of Agriculture in Maryland's Economy

Revenue Contribution: In 2022, agriculture generated approximately $3.3B in cash receipts, with broilers, corn, and soybeans as top commodities.[72]

GDP Share: Agriculture, including processing, represented about 1.3% of Maryland's total state GDP in 2022. [73]

Employment: The sector supports over 22,000 direct jobs, with additional indirect and induced impacts.[74]

Exports: Maryland ranks 29th nationally for waterborne agricultural exports, with the Port of Baltimore playing a key role. [75]

Impact of Energy Shortages

General Economic Effects

Rising Costs: Maryland is experiencing a surge in energy costs, which are contributing to the state's budget shortfall and raising concerns for ratepayers and businesses. [76]

Policy Challenges: The state's renewable energy transition has stalled, leading to higher costs without corresponding local economic benefits. [77]

Sector-Specific Impacts

Trucking: Higher energy prices increase transportation costs, directly affecting the cost of moving goods, including agricultural products and food. [78]

Ports: The Port of Baltimore, a central hub for farm equipment, vehicles, and agricultural products, is particularly vulnerable. Energy shortages or disruptions (such as the recent bridge collapse) lead to delays, higher shipping costs, and rerouting, which can ripple through the regional supply chain and increase prices. [79] [80]

Food and Agriculture: Increased fuel and input costs raise the price of food and farm operations. Delays in equipment and input deliveries due to port or energy disruptions can negatively impact planting and harvesting schedules, further driving up food prices and reducing farm profitability. [81] [82]

Role of Agriculture in Revenue Generation

Economic Contribution: Maryland's agricultural sector contributes over $8.25B annually to the state's economy, including direct, indirect, and induced impacts. [83]

GDP Share: Agriculture accounts for a modest share of Maryland's total GDP, typically around 1–2%.[84] [85]

Employment: The sector supports thousands of jobs statewide, with significant impacts in rural regions and related industries, including processing, transportation, and retail.[86] [87]

Top Commodities: Major agricultural products include broilers (chickens), corn, soybeans, and greenhouse vegetables.[88]

National Ranking: Maryland is not among the top 10 in overall agricultural output, but it ranks 29th in waterborne agrarian exports, with the Port of Baltimore playing a crucial role in transporting farm products to global markets.[89]

Regional Impact: In Southern Maryland alone, agriculture and aquaculture contribute over $158M in economic output and support more than 2,200 jobs.[90]

Land Use: Agriculture is the largest single land use in Maryland, with approximately 2 million acres—32–40% of the state's land—dedicated to farming. This makes it the most visible and extensive land-based industry in the state.[91] [92] [93]

Employment (Broadly Defined): Some sources report that agriculture supports up to 350,000 jobs in Maryland. This figure includes not only farm operators and laborers but also workers in food processing, distribution, agritourism, and related supply chain activities. When measured this way, agriculture's employment footprint is substantial, though the number of full-time farmers is much smaller (about 6,000).[94] [95] [96]

Economic Impact: Agriculture is credited with contributing more than $8B annually to Maryland's economy when considering direct, indirect, and induced effects. This broad economic impact—which includes farm production, processing, and related businesses—can make agriculture appear as the largest industry by total economic activity. [97] [98] [99]

- **Diversity and Breadth:** The sector is diverse, encompassing poultry, dairy, grains, vegetables, seafood, and agritourism. Maryland is a national leader in blue crab and soft clam production and ranks high in broiler chicken output. [100] [101] [102]
- **Rural Dominance:** Agriculture is the dominant industry in rural areas, providing jobs and supporting local economies. This regional importance reinforces the perception of agriculture as the state's largest commercial sector. [103] [104] [105]
- **Summary:** Maryland's economy in 2025 is challenged by structural deficits, a weakening business climate, and heavy dependence on federal employment and spending. The state's top industries—life sciences, cybersecurity, aerospace, and logistics—are nationally competitive; however, agriculture, although significant locally, plays a modest role in the overall GDP. Federal cutbacks and energy shortages pose substantial risks, particularly for employment, local government finances, and key sectors like trucking, ports, and agriculture, potentially leading to higher costs and economic instability. [106] [107] [108]

Assessing the Economic Impact of Increasing the Supply of Biofuels on the Price of Crude Oil, Gasoline, and Diesel Fuel

A McKinsey & Company report found that using E15 saves consumers 20-59 cents per gallon and E20 saves 18-63 cents per gallon (mileage-adjusted). As a result of ethanol's high octane, the amount of gasoline a refiner can produce from a barrel of oil increases by 3.2% for E10, 4.7% for E15, and 6.7% for E20, and avoids the economic hardship of investing in additional refining capacity. [109] The McKinsey & Company study was conducted in 2008, when ethanol production was 9.3 billion gallons annually.

The economic benefits of lower crude oil prices [from higher ethanol blends] could far outweigh the short-term benefits discussed in the DOE/NREL report. By reducing **crude oil prices**, ethanol would lower gasoline prices and other petroleum-based products, such as jet fuel and diesel. Therefore, prices for everything, including food, would decrease and help fight inflation.

Some claim that ethanol's ability to lower gasoline prices could be countered by OPEC members arbitrarily increasing oil supplies. Because that is true, biofuels are a valuable deterrent to market manipulation, especially given that the ethanol industry has twice the capacity to produce finished fuels as the U.S. Strategic Petroleum Reserve.

Key Findings from Recent Studies

- E15 (15% ethanol blend) is consistently cheaper than E10 (10% ethanol blend) at the pump. Recent studies and industry reports show that E15 typically saves consumers between 10 and 30 cents per gallon compared to E10, with some locations reporting savings of up to $1 per gallon during certain periods.[110] [111] [112] [113]

- Nationwide, these savings add up. If the U.S. were to switch from E10 to E15 as the standard fuel, consumers could save over $20B annually in fuel costs.[114] [115]
- State-level data support these findings. For example, in Minnesota, E15 was on average $0.18 per gallon less expensive than E10 in 2024. [116] Iowa drivers saved $38.5M in 2024 by choosing E15 over E10.[117]
- EPA and AAA have acknowledged the cost advantages of E15, especially during periods of high gasoline prices and increased travel demand. [118] [119]

Figure 4: Increasing the Supply of Biofuels Reduces the Price of Crude and Fuel

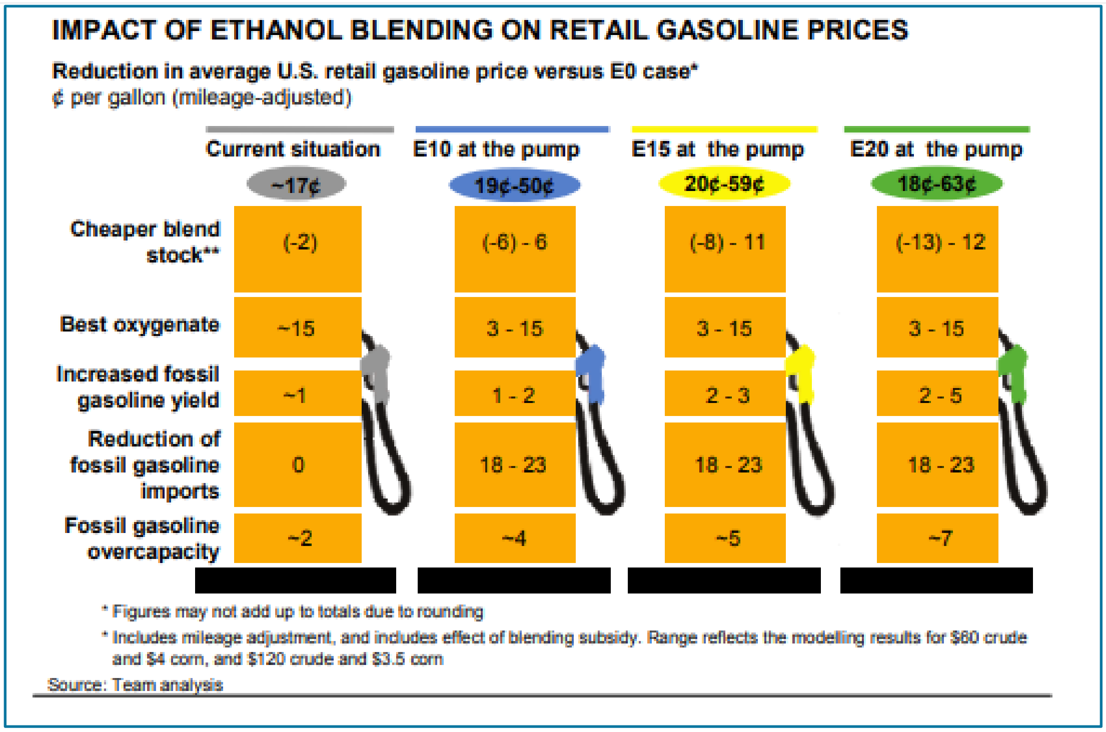


Table 18: Estimated E15 Savings for Maryland Drivers (GAP: Biodiesel)

E15 Savings ($/Gal.)	Total Annual Savings for Maryland Drivers & Truckers
$0.10	$250M
$0.30	$750M
B20 Savings	
$0.19	$149M
Total Savings	$400M to $900M

Data Table Notes: A 2022 report estimated that from 2010 to 2021, the global introduction of biomass-based diesel reduced #2 diesel prices by 8% to nearly 19% annually, depending on the year and supply levels. U.S. production alone contributed to a 1–4% reduction in diesel prices. A 4% reduction in diesel fuel prices in Maryland is equivalent to $104.7 million in annual savings. The savings can translate into lower costs for the trucking industry, farmers, and consumers. [120] [121]

Reducing Total Societal Costs Must Have Total Society Benefits

Maryland's Climate Solutions Now Act (CSNA) requires a 60% reduction in greenhouse gas (GHG or carbon) emissions by 2031. The Maryland Department of the Environment estimates that reducing carbon by 646 million metric tons would achieve a "a total societal benefit" of $135 billion (reduced costs from climate change, health

The two beneficiaries of increasing the production and use of cleaner biofuels are the public and the government.

Tobacco and gasoline share similar challenges. Addiction aside, smoking and using tobacco are individual choices. However, everyone pays the total societal cost of a smoker, even if they never smoked. Gasoline is no different—whether you drive a Hummer, wait at a bus stop, or live near a highway, everyone is forced to breathe the pollution and pay for the damage in higher health care and property insurance premiums. Federal and state governments are not a magic source of money. Every consumer and taxpayer bears the costs.

That's why expanding the use of biofuels matters first from an economic security standpoint. It reduces pollution and the harm from it, saves money, and strengthens our national security.

Perspective and Comparative Analysis: TSI (Total Societal Impact) costs encompass not only direct pump prices but also hidden costs incurred through taxes, subsidies, job losses, healthcare premiums, and environmental damages.

- Defense spending to protect oil supplies and subsidized prices further escalates the true cost, but these costs are dispersed through general taxation, not at the pump.
- Global health impact and premature deaths due to air pollution from gasoline use represent some of the most significant hidden costs, according to WHO, IMF, and EPA studies.
- Biofuel blending and cleaner fuels statistically lower both retail gasoline prices and overall societal impact, resulting in savings and reduced pollution.

Table 19: Total Society Costs of Crude Oil & Fuels

Cost Component	Estimated Cost
Healthcare Costs	$1.7 trillion/year
TSI Estimate (NRDC)	$15/Gallon
TSI Estimate (Fuel Freedom)	$6.13/Gallon
TSI Estimate (NDCF)	$5.28 Gallon
Economic Penalties (NDCF)	$304.9B/year
Lost Jobs due to Oil Dependence	828,400 jobs/year
Loss of GNP due to Oil	$159.9B/year
Loss of Federal/State Revenue	$13.4B/year
Air Pollution/Premature Deaths	1.2M deaths/year (global)
Global Fossil Fuel Subsidies	$500B/Yr. (US, IMF 2015)
EPA Clean Air Act Benefits	$2 Trillion (US)

International Context Use Cases: The Economics, Environmental Security, and Impact of Supply on Demand

Brazil's Biofuel Supply and Demand Use Case

Over 80% of Brazilian vehicles can run on any combination of gasoline and ethanol. In March 2025, the Brazilian Ministry of Mines and Energy (MME) recommended increasing the 27% minimum ethanol content in Brazil's gasoline by 3% to 30% (E30). The increase in supply could lower gasoline prices by up to R$0.13 per liter (~9 cents per gallon). The "Fuel of the Future" law aims to increase domestic biofuel production and reduce reliance on imported gasoline.

Crude Oil Gets a Case of COVID Use Case

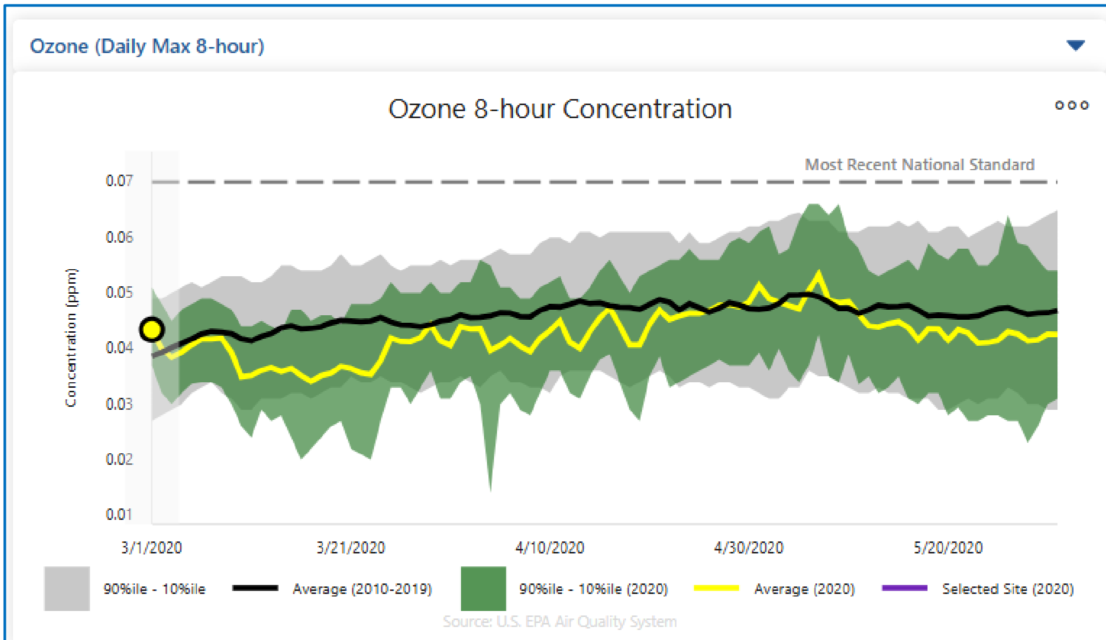
In April 2020, during the peak of the COVID-19 lockdowns, global demand for crude oil and gasoline plummeted as travel and economic activity came to a halt. This led to an unprecedented situation in which the price of West Texas Intermediate (WTI) crude oil dropped below zero, reaching a low of– $37.63 per barrel on April 20, 2020, due to oversupply and storage constraints. [122] [123] [124] [125]

- ☑ Gasoline demand in the U.S. fell sharply, with consumption dropping by approximately 1.2 million barrels per day compared to 2019, and Americans drove 40% fewer miles in April 2020 than they had in the previous year.[126] [127]
- ☑ As a result, average national gasoline prices dropped by about 17% compared to 2019, with the average price at the pump falling by nearly 40 cents in April 2020.[128] [129]

Air Quality During the Same Period

- ☑ The sharp reduction in transportation and industrial activity during COVID-19 lockdowns led to significant improvements in air quality worldwide.[130]
- ☑ Major cities experienced substantial decreases in pollutants, including nitrogen dioxide (NO_2) and particulate matter (PM2.5 and PM10), which are directly linked to reduced vehicle traffic and industrial emissions.[131]
- ☑ These improvements highlighted the strong connection between human activity and urban air pollution, with many regions experiencing their cleanest air in decades during the strictest lockdown periods.[132]

Figure 5: COVID-19 Use Case: Reducing Crude Oil and Gasoline Consumption Reduces Air Pollution



Starting in mid-March 2020, many areas across the United States implemented stay-at-home restrictions in response to the COVID-19 pandemic that closed schools, workplaces, and businesses. As a result, vehicle travel significantly dropped, and we saw lower ambient concentrations of several pollutants including nitrogen dioxide (NO_2) and ozone (O_3). This graph shows the daily concentrations of NO_2 and O_3 in the spring of 2020 compared with historical values from 2010-2019.

International Context: Are trade wars and tariffs an economic disaster or an opportunity for environmental and economic security?

Food, Fuel, and Feed Security

Over the past decade, U.S. farmers have experienced significant erosion in their export position to China, their once-largest and most reliable customer. What began with trade war tariffs in 2018 has since deepened, as China has turned to Brazil, Argentina, and other suppliers for soybeans, corn, and high-protein feed. The result has been billions of dollars in lost sales each year, a shrinking market share, and long-term uncertainty in the most critical agricultural export relationship. Taken together, these setbacks have cost American farmers tens of billions of dollars, underscoring both the vulnerability of export-driven markets and the need for a diversified, resilient agricultural economy.

Corn "Stocks" Growing Up or Going Down

China has sharply reduced its corn imports from the U.S.—for example, in the 2024-25 marketing year, China's corn imports from the U.S. dropped about **79% year-over-year**.

A recent study (by NCGA/ASA) estimated that renewed tariffs or trade war escalation could cause U.S. corn exports to China to drop by approximately 2.2 million metric tons annually, corresponding to an average decline of 84.3% from the baseline export volume that would have occurred without those tariffs.

Even with China back in the picture in other global markets, the loss of the Chinese market (in volume and value) has been significant. U.S. suppliers are trying to redirect corn exports to other buyers in Asia (Japan, South Korea, Vietnam), but the lost demand from China is hard to replace fully.

Impact on DDGS Exports

- DDGS used to be a significant export from the U.S. to China. In 2015, over 6.5 million metric tons, valued at around $2 billion, were shipped to China. But after China imposed antidumping and countervailing duty (AD/CVD) tariffs (and other regulatory barriers), U.S. DDGS exports to China essentially collapsed. For example, in 2024, only ~331,400 metric tons of U.S. DDGS were exported to China, down from millions of tons.[133]
- The U.S. industry has managed to redirect much of that lost volume to other countries—for example, Mexico, South Korea, Indonesia, Turkey, Colombia, Vietnam, etc. However, these alternative markets, while helpful, generally offer lower margins or higher logistical costs. Also, the loss of China as a buyer reduces bargaining power and scale economies.
- More recently, total U.S. DDGS exports have declined: in the early months of 2025, the U.S. saw about a 7 percent drop in overall DDGS exports relative to the same period in 2024.

Biofuel Diplomacy

Similar to the EPA's lead phasedown program, if the percentage aromatic content in gasoline were to decrease by 5% and be replaced with an increase of 5% ethanol (from E10 to E15), demand for ethanol would increase by 6.02B gallons per year—if consumers purchased E15 100% of the time.

Baseline Data and Assumptions

Production and Processing

- 6.02B gallons of ethanol demand would require 2.15B more bushels of corn, representing a growth in demand of 16.78%.
- The U.S. currently exports about 2.5B bushels of corn. If tariffs are imposed, ethanol plants would need to convert 2.5 billion bushels of corn into 7 billion gallons of ethanol.
- Processing 2.5B bushels of corn into ethanol yields substantial byproducts and creates significantly more value than selling raw corn.

Products and Quantities

- Protein feed (DDGs): 45B pounds (22.5MMT)
- Ethanol: 7B gallons
- CO_2: 15.4B pounds

Total Value of Products

- DDGs revenue: 22.5M tons × $225/ton = $5.06B
- Ethanol revenue: 7B gallons × $2.00/gallon = $14.00B
- CO_2 revenue: 15.4B pounds × $0.30/pound = $4.62B
- Total value from processing: $5.06B + $14.00B + $4.62B = $23.68B

Value Comparison

- Raw corn value: 2.5B bushels × $4.20/bushel = $10.50B
- Value difference: $23.68B (processed) - $10.50B (raw) = $13.18B

This analysis shows that processing corn into ethanol and byproducts generates 126% more value than selling raw corn. The added value primarily comes from ethanol production (59% of total revenue), followed by DDGs (21%) and CO_2 (20%).

Impact on Soybean Growers

Soybeans have long been one of America's most significant agricultural exports, with China historically the top buyer. However, in recent years, trade tensions, tariffs, and Brazil's rising production have eroded that dominance. As those shifts persist, U.S. soybean and soymeal exporters are feeling the effects, not just in terms of volume sold, but also in lost market share and revenue.

Key Insights

Retaliatory Tariffs & Overall Agricultural Export Losses

One USDA Economic Research Service study estimated that retaliatory tariffs (2018–2019) caused U.S. farmers to lose **$27 billion** in agricultural exports (total across many commodities) — with China responsible for the bulk of that. Specifically, exports of soybeans, wheat, and corn were heavily affected. Soybeans saw the biggest dollar and percentage losses.

Reduction in Exports to China

Between June 2024 and June 2025, U.S. agricultural exports to China dropped by **39%**.

Before the U.S.–China trade war (2017), ~28–31% of U.S. soybean production was exported to China. During the trade war, U.S. soybean exports to China dropped sharply (tariffs, retaliation), with losses estimated at **$9.4 billion annually** for soybeans alone.

In volume terms, retaliatory tariffs are estimated to have reduced U.S. soybean exports by ~24% overall, and exports to China by around 48% (≈~17 million metric tons).[134] The U.S. has "missed out" on **14–16 million metric tons** of soybean sales to China in the 2025/26 season due to competition from South America and stalled trade talks.

In 2024, U.S. soybean exports to China were about **$12.8 billion**, down from ~$15.1B in 2023, and down sharply from earlier peaks.

Rough Estimate of Total Loss

Combining these estimates, a plausible range suggests that U.S. farmers have lost $20–$40 billion in exports over recent years due to China's increased purchases from other suppliers (e.g., Brazil, Argentina), resulting from tariffs, trade disruptions, or other competitive disadvantages.

Context, Perspective, and Impact

Context

Maryland's economy faces a convergence of pressures, including budget deficits, rising energy costs, a heavy dependence on federal spending, and a fragile agricultural base that is threatened by global trade volatility. At the same time, the state is under pressure to meet ambitious climate targets and manage the escalating costs of pollution on public health and infrastructure. Against this backdrop, biofuels offer a uniquely integrated solution: supporting Maryland's farmers, lowering fuel and food price volatility, and insulating households and businesses from the instability of global oil markets.

Perspective

Biofuels are not merely an agricultural subsidy or an environmental program—they are a strategic tool that strengthens Maryland's economic foundation while addressing its fiscal, energy, and environmental challenges. By preserving farmland, biofuels safeguard the state's largest land-based commercial sector. By diversifying the fuel supply, they reduce inflationary shocks tied to oil and electricity. By reducing air pollution, biofuels help mitigate public health costs that erode both state budgets and household incomes. In short, biofuels bridge the gap between Maryland's immediate economic security needs and its long-term climate and energy goals.

Impact

Expanding biofuel use positions Maryland to:

- Stabilize Household and State Budgets: Reduce consumer fuel costs by hundreds of millions annually while cutting healthcare expenditures tied to air pollution.
- Preserve and Grow Jobs: Support the agricultural economy, processing industries, and clean-energy investments that provide stable employment even amid federal cutbacks.
- Strengthen Fiscal Resilience: Mitigate the risks of global oil price spikes and federal policy shifts that drive volatility in revenues and borrowing costs.
- Advance Climate Goals: Deliver measurable carbon reductions, aligning with federal GREET lifecycle standards while closing Maryland's emissions gap.
- Protect Long-Term Competitiveness: Establish biofuels as a hedge against global market disruptions and a driver of sustainable, locally anchored economic growth.

In summary, biofuels are a high-leverage investment in Maryland's economic security—one that protects the present while laying the foundation for resilience, prosperity, and climate leadership in the decades to come.

Section 2: Energy Security

Assessing Maryland's Energy Security Challenges and the Benefits of Increasing the Use of Biofuels

Maryland's Energy Supply is Vulnerable

Maryland does not produce crude oil, gasoline, or alternative fuels. It does not have a strategic liquid fuel reserve to draw upon in the event of a national or local emergency resulting from geopolitical instability in the Middle East, cybersecurity attacks on pipelines or utilities, or changing weather patterns. Maryland is also home to several strategic military bases, Coast Guard and National Guard facilities, major shipping ports, and airports, as well as several federal agencies with homeland security responsibilities, including the Secret Service, TSA, DHS, FEMA, CDC, and the National Guard and Coast Guard.

Key Insights

The Center for International and Security Studies at Maryland Cyber Events Database has recorded 13,327 cyber events between 2014 and 2023. [135]

The May 2021 cyberattack on Colonial Pipeline significantly impacted Maryland's gasoline prices and economic security, highlighting vulnerabilities in critical infrastructure. The cyberattack led to a temporary shutdown of Colonial Pipeline, which supplies approximately 45% of the East Coast's fuel. In Maryland, this disruption resulted in gasoline shortages and price increases. On May 13, 2021, AAA Mid-Atlantic reported that 34% of gas stations in Maryland were experiencing fuel outages. Meanwhile, the average gas price in Maryland increased to $3.01 per gallon, up from $2.92 just a few days earlier.

Consistent with the federal regional emergency declaration, the Colonial Pipeline cybersecurity attack prompted then-Governor Larry Hogan to authorize the Maryland Department of Transportation to take emergency measures to ensure continuity of fuel supply throughout the state. The measures included issuing emergency waivers of weight restrictions and hours-of-service requirements for Maryland motor carriers, as well as utilizing alternative transportation methods, such as barges, to deliver fuel to the Port of Baltimore. The response also called for a coordinated effort by various state agencies, including the Maryland Energy Administration, the Maryland Department of the Environment, and the Maryland Emergency Management Agency, to address the fuel supply disruption. These actions were crucial in mitigating the economic impact on businesses and consumers.[136]

Approximately 40% of Maryland's electricity is imported from out-of-state.[137] More than 36% of imported electricity was generated from coal. This share can be even higher at peak times, with real-time market data indicating that up to 70% of imported electricity may be coal-generated during certain intervals. The remainder of imported electricity is primarily sourced from natural gas and, to a lesser extent, from nuclear and renewable sources, reflecting the generation mix of the broader PJM regional grid.[138]

Maryland's electric cooperatives are facing challenges in keeping up with the increasing demand for electricity. This is due to a combination of factors, including increased energy use from data centers, large manufacturers, and electric vehicle charging infrastructure, as well as delays in the permitting process and supply chain issues.[139]

Electric Vehicle Mandates in Maryland's Climate Solutions Now Act (CSNA)

State Agency Fleet Vehicle Requirements

The CSNA requires Maryland to increase the purchase of zero-emission vehicles (ZEVs) for the state fleet on a set schedule:

- From 2023 to 2025, at least 25% of new passenger car purchases for the state fleet must be ZEVs.
- This requirement increases to 100% of new passenger car purchases by 2028.
- Similar targets are set for light-duty vehicles, but with slightly later deadlines. [140]

Advanced Clean Cars II (ACC II) Rule

There is currently no mandate in the CSNA or related Maryland law that requires all Maryland drivers to purchase electric vehicles by a certain date.

Instead, Maryland has adopted the Advanced Clean Cars II (ACC II) rule, which requires auto manufacturers to increase the percentage of zero-emission vehicles they sell in Maryland, reaching 100% of new passenger car and light truck sales by model year 2035.[141] [142]

This means that after 2035, new gas-powered cars and light trucks will no longer be sold by manufacturers in Maryland, but existing vehicles can continue to be owned and operated. There is no requirement for current owners to replace their vehicles with EVs, nor is there a ban on the resale of used gasoline vehicles.[143] [144]

Table 20: CSNA EV Requirements

Requirement	Deadline/Year	Applies To
25% of state fleet purchases ZEVs	2023-2025	State agency passenger cars
100% of state fleet purchases ZEVs	By 2028	State agency passenger cars
100% of new car/light truck sales are ZEVs	By 2035	Vehicle manufacturers (not individual drivers)

Sources and notes for the data table:

- The CSNA sets ambitious greenhouse gas reduction goals, aiming for a 60% reduction below 2006 levels by 2031 and net-zero emissions by 2045.[145] [146]
- Maryland has set a goal of 600,000 zero-emission vehicles registered in the state by 2030.[147]
- Recent executive actions have temporarily eased enforcement of penalties for manufacturers not meeting ZEV sales targets in model years 2027 and 2028, due to supply chain and infrastructure challenges.[148]

Key Insights

All new passenger cars and light trucks sold in Maryland must be zero-emission vehicles starting with model year 2035. There is no mandate requiring all Maryland drivers to purchase EVs or to replace their existing vehicles with EVs.[149] [150] State agency fleets must purchase only ZEVs for passenger cars by 2028.[151]

- In March 2023, Maryland officially adopted the Advanced Clean Cars II (ACC II) rule, following California's lead in setting stricter vehicle emissions standards.[152] [153]
- ACC II requires automobile manufacturers to steadily increase the percentage of zero-emission vehicles (ZEVs)-which include battery electric vehicles (EVs), plug-in hybrid electric vehicles (PHEVs), and hydrogen fuel cell vehicles-sold in the state each year, culminating in a mandate that 100% of new passenger car and light truck sales be ZEVs by model year 2035.[154] [155] [156]
- The requirements apply to manufacturers, not directly to individual consumers or dealerships.[157]
- The percentage of new ZEV sales ramps up annually, reaching 100% by 2035.[158] [159] [160]
- Internal combustion engine vehicles (ICEVs) sold before 2035 can continue to be owned, operated, and resold in the used market.[161]

- ACC II also includes compliance flexibility and incentives for manufacturers to provide ZEVs in underserved communities.[162]

Implementation Timeline

- Maryland's ACC II regulation will take effect starting with model year 2027 vehicles.[163]
- There is a "gap year" in 2026, during which the state will revert to federal standards, giving manufacturers additional lead time to prepare for compliance.[164]
- Enforcement of penalties for failing to meet ZEV sales targets in model years 2027 and 2028 will be temporarily eased, as directed by a 2024 executive order in response to industry and infrastructure challenges.[165]

Purpose and Impact

ACC II is a cornerstone of Maryland's broader climate strategy, supporting the Climate Solutions Now Act's goals of reducing greenhouse gas emissions by 60% from 2006 levels by 2031 and achieving net-zero emissions by 2045.[166] [167] The rule is expected to yield significant reductions in air pollutants and greenhouse gas emissions, along with benefits for public health and the economy.[168]

Table 21: ACC II Summary Table

Requirement	Applies To	Deadline/Year
Steadily increasing ZEV sales	Auto manufacturers	2027–2034
100% of new passenger car/light truck sales are ZEVs	Auto manufacturers	Model year 2035

National Perspective: The Impact of Biofuels on Economic and Energy Security

Ethanol

On a national level, 200 plants in 23 states produce 16 billion gallons per year (BGPY) of ethanol, 35 million tons of animal feed, and 4.2 billion pounds of corn oil. The industry created 395,000 jobs, added $55 billion to the GDP, $10 billion to federal/state/ local budgets, and $32 billion to household income.

Biodiesel

There are 56 plants across 25 states producing 5 BGPY of biomass-based diesel, 71MMT of soybean meal, and 1.6 MMT of glycerin. This $6 billion investment in the industry generates $23 billion in economic activity, supporting $3.6 billion in annual wages for 75,200 workers. The $6 billion industry investment generates $23 billion in economic activity, which supports $3.6 billion in annual wages paid to 75,200 workers (2024 Clean Fuels Alliance).

Fuel Availability and Vehicle Compatibility

Alternative fuel and biofuel station locator tools make it easier for fleets and consumers to find higher-ethanol and biodiesel blends. The U.S. DOE's Alternative Fuels Data Center (AFDC) Station Locator is the most comprehensive tool, covering E85, biodiesel (B20 and above), renewable diesel, and other alternative fuels nationwide. Specialty apps such as Find E85, Find D15, and Ethanol Free focus on niche markets, while biodiesel-specific locators supported by Clean Cities and industry groups highlight retail and wholesale access points. These platforms provide reliable information on station availability, pricing, and compatibility for drivers seeking low-carbon fuel options.

Table 22: Biofuel Finder Apps & Audience Data

App	Downloads / Users / Audience Notes	Hashtags / Keywords Used
GasBuddy	Over **100 million downloads** on Google Play, with a very large user base. Google Play	#GasBuddy, #CheapGas, #FuelSavings
E85 Stations USA	~50,000+ downloads on Google Play; ~1.66K reviews. Google Play	#E85, #FlexFuel, #AlternativeFuel
Pearson Fuels – E85 Stations	10,000+ downloads; ~174 reviews. Google Play	#E85, #Biodiesel, #FeelGoodFuel
E85 App (Ahmed Elsayed)	Smaller audience: on Apple App Store with only ~9 ratings as of the recent version. Apple	#E85, #MixCalculator

There are ~147,000 gas stations in the United States. Single-owner store operators are responsible for selling more than 60% of gasoline, while larger chains with over 500 locations account for 15% of sales.

There are 1,800 gas stations in Maryland. According to the DOE/AFDC, 49 stations offer E85 (85% ethanol), 26 offer E15 (15% ethanol), and no stations offer biodiesel or renewable biodiesel blends above 20%. Some of the largest gasoline retailers in Maryland currently do not provide consumers with the option to purchase higher blends of biofuels.

Table 23: Retail Fuel Stations Selling Higher Blends of Ethanol

Fuel Type	# of Stations
E85 (85% ethanol)	4,452
E15 (15% ethanol)	1,103
Mid-Level Ethanol Blends (E20–E40)	347
Biodiesel/Renewable Biodiesel (>20%)	2,941

Source: U.S. Department of Energy's Alternative Fuel Data Center (DOE/AFDC) station locator.

Table 24: Major Retail Fuel Providers in Maryland

Brand/Company	Estimated Stations in MD	Stations with Higher Blends of Biofuels	Type
301 Truck Stop	1	0	Truck stop/travel center
Amoco	**~7**	**0**	**Oil company/national brand**
BP	**Not specified**	**0**	**Oil company/national brand**
Carroll Motor Fuels	Not specified	0	Independent/regional jobber
Citgo	**~76**	**0**	**Oil company/national brand**
Costco	**4**	**0**	**Membership/national box store**
Crown	Not specified	0	Independent/small chain
Dash In Food Stores	~55	0	Convenience/regional
Exxon Mobil	**~269**	**0**	**Oil company/national brand**
Four Corners Auto Services	Not specified	0	Local fuel provider
Giant Food	7+	0	Grocery/supermarket
Harris Teeter	1+	2	Grocery/supermarket
High's Dairy Store	~50	1	Convenience/regional
Liberty	Not specified	0	Independent/small chain
Marathon	**~66**	**0**	**Oil company/national brand**
MARTINS Food Stores	5	0	Grocery/supermarket
Pilot Flying J	6	0	Truck stop/travel center
Quarles Petroleum	22	0	Fuel supplier/jobber
Royal Farms	**~200+**	**25**	**Convenience/regional**
Safeway	13	0	Grocery/supermarket
Sams Club	~3	0	Membership/box store
Sheetz	**~30**	**16**	**Convenience/regional**
Shell	**~283**	**2**	**Oil company/national brand**
Sunoco	**Not specified**	**1**	**Oil company/national brand**
TravelCenters of America	3	0	Truck stop/travel center
Valero	**~18**	**0**	**Oil company/national brand**
Wawa	**~50**	**0**	**Convenience/regional**
Bethesda W Express	Not specified	1	Local
Fort Meade Auto Center	Not specified	1	Local
Fredericktown W Express	Not specified	1	Local
Gaithersburg W Express	Not specified	1	Local
Glenn Dale Mini Mart	Not specified	1	Local
Social Security Administration	Not specified	1	Local

Vehicles

Maryland has 4.3M vehicles with internal combustion engines (ICE). Approximately 97% of the gasoline sold in Maryland is consumed by vehicles EPA-approved for use with E15. 326,900 Flexible Fuel Vehicles (FFVs) can use up to 85% ethanol. Maryland has 34,472 Plug-in ICE Hybrids, which combine batteries and gasoline, and 86,367 dedicated battery-powered electric vehicles (EVs). Therefore, most cars built in the last 10 years and in the next 10 years will still be on the road, burning gasoline in 2043.

Over 50% of vehicles purchased by consumers in Maryland "require or are recommended " by the manufacturer to use premium gasoline. Approximately 20% of premium gasoline is composed of "aromatic" octane enhancers. Aromatics, i.e., **B**enzene, **T**oluene methylbenzene, **E**thylbenzene, and **X**ylene dimethylbenzene (**BTEX**), are the most carbon-intensive and carcinogenic compounds in gasoline.

Fuel Demand

Maryland consumes 2.8B gallons of gasoline and 748M gallons of diesel fuel per year.

One gallon of ethanol has about 50% less carbon than one gallon of gasoline. [169] Biomass-based and renewable biodiesel reduces carbon by 40% to 69% when produced from soybean, canola, and carinata oils, and 79% to 86% when produced from tallow, used cooking oil, and distillers' corn oil.

Maryland's diesel engine landscape and fuel consumption can be summarized as follows, based on available data:

Table 25: Maryland Transportation Fuel Consumption Data

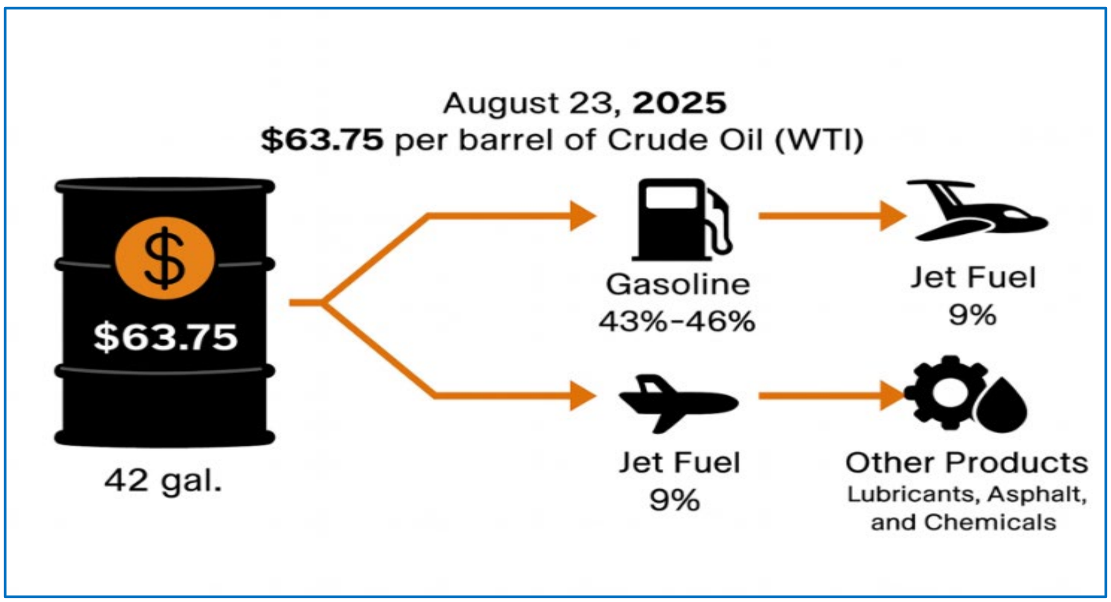
Category	Quantity/Consumption	Key Details	Sources
Diesel-Powered Buses	25,970	Class 3-8 buses (transit, school, intercity)	[170]
Diesel Trucks	~187,924	Includes 159,088 single-unit work/freight trucks and 28,836 combination trucks	[171]
Aviation Fuel (Jet)	293.8M gallons/year	Primarily consumed at BWI Airport (730,800 gallons/day) and other airports.	[172]
Gasoline Consumption	2.8B gallons	62% of Maryland's total liquid fuel consumption	User input
ICE Vehicles	4.3M registered	Includes 326,900 FFVs and 34,472 plug-in hybrids	User input
Biodiesel Infrastructure	25 private stations	Biodiesel (B20+) availability	. [173]

Data Table Notes:

1. Diesel dominates Maryland's medium/heavy-duty fleet (64% of vehicles),[174] with gasoline used in 36% of smaller trucks.[175]
2. Jet fuel represents 9% of Maryland's total liquid fuel consumption,[176] while diesel accounts for 24%.[177]
3. Data limitations exist for:
    - Railroad diesel use
    - Backup generators
    - Off-road industrial equipment
    - Home heating oil systems

The transportation sector accounts for 80% of Maryland's petroleum consumption, with diesel playing a critical role in freight and public transit operations.[178] While biodiesel infrastructure exists, specific consumption data for off-road/industrial applications remains unavailable in the reviewed sources.[179]

Table 26: Average Product Yields Per Barrel of Crude Oil



Challenge and Opportunity: U.S. Biofuel Production is a Strategic Fuel Reserve

The 21 billion gallons per year of U.S. biofuel production is 3 times larger than the U.S. Strategic Petroleum Reserve.

- Emergency releases from the SPR have historically occurred during crises to stabilize energy markets and reduce fuel prices, often having a measurable effect on gasoline costs.
- SPR releases have generally led to lower fuel prices, with Treasury analyses showing price decreases of up to 31 cents per gallon following the 2022 releases.
- Each emergency drawdown has helped maintain supply reliability during wars, market shocks, or natural disasters.
- 404M barrels (MMBBL) of crude oil, stored in underground caverns in Texas and Louisiana, are valued at over $20 billion.
- Assuming a 42% average gasoline yield per barrel, the entire SPR would produce 7.1 billion gallons of gasoline for about 3 months.

Table 27: Strategic Petroleum Reserve Crude Oil Supply

Crude Released (barrels)	Gasoline Yield (barrels)	Gasoline Yield (gallons)	Initial Market Delivery	Maximum Daily Drawdown	Full Release Duration
404,000,000	169,680,000	7.1B	~2 to 4 weeks	4,400,000	~92 days

Significant SPR Releases

- Gulf War (1991): ~17 MBBL of oil = 300MMGAL of gasoline
- Hurricane Katrina (2005): ~30M BBL = 529MM GAL gasoline.
- Libya (2011): ~30 MBBL = 52MM GAL gasoline.
- COVID-19 pandemic (2020): Several releases totaling ~50M BBL = 882MM GAL of gasoline.
- 2021 and 2022 Price Spikes: 180M BBL was released = 3.1B gallons of gasoline.

Perspective: On February 20, 2025, "The American Petroleum Institute, along with fuel marketers and retailers, biofuels producers, and agriculture stakeholders, recognizes the critical role liquid fuels serve in the American economy. In a letter to U.S. Environmental Protection Agency Administrator Lee Zeldin, the organizations urged the agency to fully leverage the Renewable Fuel Standard to support the administration's goal of U.S. energy dominance."[180]

National Security Impacts Maryland's Energy Security

The United States spent $1.8 trillion on oil imports over the past decade.[181] The U.S. accounts for 4% of the world's population,[182] 17% of oil demand,[183] 22% of oil production,[184] and 2.8% of proven oil reserves.[185]

Saudi Arabia accounts for 11% of global oil production and 17% of proven oil reserves. [186] Russia accounts for 11% of global oil production and 5% of proven oil reserves. [187] China represents 17% of the world's population, 28% of oil demand, and 1.5% of proven oil reserves.[188] [189]

Table 28: Crude Oil Demand, Production, and Proven Reserves Comparison

Country	% of World Population	% of World Oil Demand	% of World Oil Production	% of World Proven Oil Reserves
United States	**4%**	**17%**	22%	**2.8%**
Saudi Arabia	0.46	4%	11%	**17%**
Russia	1.8	4%	**11%**	**5%**
China	**17%**	**28%**	**5%**	**1.5%**

World View: OPEC and the Economics of Crude Oil and Gasoline Supply and Demand

The Organization of the Petroleum Exporting Countries (OPEC) is an intergovernmental organization founded in 1960 that coordinates petroleum policies and sets oil production targets among member nations to influence global oil prices.

- OPEC+ was formed in 2016 to increase global oil market stability, with both OPEC and non-OPEC members collectively determining output quotas and supply cuts.
- Nearly all OPEC/OPEC+ members have either current or potential diplomatic, military, or economic friction with the U.S.
- U.S. policy toward these energy exporters is deeply influenced by both strategic interests and human rights priorities, shaping trade, sanctions, and security relationships.

Table 29: OPEC and OPEC+ Member Countries

Group	Country	U.S. Conflict / Potential Conflict	Human Rights Violation/Concern
OPEC	Algeria	Moderate tension, energy/security	Autocracy, press freedom
OPEC	Congo	Possible instability	Protests, governance issues
OPEC	Equatorial Guinea	Limited U.S. conflict	Severe abuse, authoritarian regime
OPEC	Gabon	No major conflict	Post-election violence
OPEC	Iran	High tension, nuclear dispute, sanctions	Major repression, executions
OPEC	Iraq	Security concerns, periodic military tension	Sectarian violence, governance
OPEC	Kuwait	Occasional diplomatic tension	Gender, migrant labor rights
OPEC	Libya	U.S. military/security intervention	Civil war, rights abuses
OPEC	Nigeria	Corruption, terrorism, counter-terror mission	Insurgency, extrajudicial killings
OPEC	Saudi Arabia	Diplomatic strains (Khashoggi, Yemen, oil)	Major repression, women's/migrant rights
OPEC	UAE	Disputes, Yemen involvement	Authoritarianism, labor rights
OPEC	Venezuela	Sanctions, regime crisis	Major violations, opposition crackdowns
OPEC+	Azerbaijan	Nagorno-Karabakh, moderate tension	Media and activists suppressed
OPEC+	Bahrain	Strategic partner, protests/crackdowns	Political repression, dissent
OPEC+	Brunei	No major conflict	Limited political freedoms
OPEC+	Kazakhstan	Russian alliance, protest crackdowns	Political repression, free speech limits
OPEC+	Russia	Major conflict (Ukraine war, sanctions)	Severe abuses, political repression
OPEC+	Mexico	Trade/migration disputes, cartel violence	Crime, disappearances, and corruption
OPEC+	Malaysia	Minor tensions, trade disputes	Religious/press freedom limits
OPEC+	South Sudan	Humanitarian crisis, civil war	War crimes, genocide risk
OPEC+	Sudan	Humanitarian crisis, sanctions	Genocide, war crimes, repression
OPEC+	Oman	U.S. cooperation	Moderate rights concerns

Key Points from International Legal Analyses

International legal analyses examine OPEC's market control and legal status, although these analyses often highlight complexities and unresolved legal questions rather than provide definitive endorsements or condemnations.

OPEC's Legal Status as a Cartel: International law scholars recognize that OPEC coordinates production and pricing among its member states, a behavior typical of cartels. However, because OPEC comprises sovereign states rather than private companies, its legal status under international and domestic antitrust law is debated. [190] [191] [192]

WTO and GATT Compliance: Legal analyses have explored whether OPEC's production and pricing controls violate international trade law, specifically Article XI of the General Agreement on Tariffs and Trade (GATT), which prohibits quantitative export restrictions. Some argue that OPEC's practices are not direct export restrictions and thus may not clearly violate GATT. In contrast, others contend that the intent and effect of OPEC's quotas constitute a restriction on trade.[193] [194]

Sovereign Immunity and Enforcement Challenges: Legal scholars note that OPEC and its member states benefit from sovereign immunity, making it difficult for other countries or private parties to challenge OPEC's actions in international courts. Despite its market influence, this has led to a lack of binding legal decisions against OPEC.[195] [196]

U.S. and EU Perspectives: Under U.S. antitrust jurisprudence, OPEC's quota agreements would likely be illegal if conducted by private entities. However, because OPEC is an intergovernmental organization, it is not subject to U.S. or EU competition law unless specific legislation (such as the proposed NOPEC Act in the U.S.) is enacted to remove sovereign immunity.[197] [198]

International Law and Attribution of Responsibility: If OPEC's actions were to be challenged, responsibility could be attributed to the organization and to individual member states. Still, the lack of a clear international forum for such claims complicates enforcement.[199] [200]

Table 30: Legal Analysis of the Inability to Control OPEC

Issue	Legal Analysis Summary
Cartel Status	OPEC acts as a cartel, but its status as a group of sovereign states complicates legal challenges to its actions.[201] [202]
WTO/GATT Compliance	OPEC's practices are debated under GATT Article XI, with no clear international ruling.[203] [204]
Sovereign Immunity	OPEC and its members benefit from sovereign immunity, limiting legal challenges.[205] [206]
U.S./EU Antitrust Law	OPEC would be illegal under U.S. antitrust law if not for sovereign immunity.[207] [208]

International legal analysis supports the claim that OPEC exercises significant market control through coordinated production and pricing. Still, they also emphasize that OPEC's status as an intergovernmental organization creates legal complexities that have prevented direct legal challenges or clear rulings against its practices.[209] [210] [211]

About 66% of the world's proven oil reserves are in the Middle East, primarily in countries like Saudi Arabia, Iran, Iraq, Kuwait, the UAE, and Libya.

Context and Perspective

Maryland's energy challenges are not confined to economics alone. Volatile oil prices ripple through inflation, household budgets, and state revenues, but they also extend to the realm of national security. For more than eight decades, U.S. foreign policy has been shaped by the need to safeguard global oil supplies, often at considerable cost. With Maryland home to critical military installations, ports, and supply chain infrastructure, the state sits at the intersection of these broader geopolitical dynamics. Recognizing this dual exposure highlights why the following section focuses on the national security dimension of energy, and how expanding the use of biofuels provides both a shield against foreign dependence and a strategic advantage for the state and the nation.

Section 3: National Security

Assessing the Impact of National Security Challenges on Maryland's Energy Security Challenges, and the Benefits of Increasing the Use of Biofuels

Global Oil Markets and Geopolitical Risks Impact Maryland's Energy Security

Maryland's energy security is deeply tied to global oil markets and the associated geopolitical risks. Because the Organization of the Petroleum Exporting Countries (OPEC and OPEC+) controls the vast majority of the world's proven reserves, supply shocks and price manipulation abroad translate directly into higher costs, economic instability, and national security vulnerabilities at home. History shows that nearly every U.S. recession in the modern era has been preceded by an oil price spike, an event that ripples through inflation, interest rates, and household budgets. For Maryland, these pressures pose a threat to both the state's fiscal stability and the individual economic and personal security of its residents. Expanding the use of biofuels provides a strategic hedge, reducing exposure to foreign oil volatility while supporting domestic agriculture and cleaner energy.

Key Insights

- **Global Oil Control:** OPEC nations hold ~80% of proven reserves, and OPEC+ collectively manages up to three-quarters of global oil supply—giving them outsized leverage over world prices.
- **Strategic Priority:** Every U.S. administration since Roosevelt has tied Middle East oil security directly to U.S. national and economic security, often justifying military commitments.
- **Price Shocks & Recessions:** Ten of the last eleven U.S. recessions were preceded by sharp oil price spikes, demonstrating the persistent link between energy volatility and economic downturns.
- **Economic Consequences:** Each $10 per barrel increase in oil prices typically raises inflation by 0.2%, raises interest rates, and cuts U.S. GNP by ~0.5%, magnifying risks for state budgets and households.
- **Maryland Vulnerability & Opportunity:** Higher oil costs drive up spending on energy assistance, reduce tax revenues, and strain families—but biofuels can mitigate these risks by enhancing local energy resilience and diversifying supply.

Global Crude Oil Reserves

When OPEC+ (OPEC members plus allies like Russia and Mexico) is considered, the group controls roughly 70% to 76% of all proven oil reserves worldwide (OPEC's 70% plus Russia's additional 6%).[212]

Table 31: The Middle East Controls Two-Thirds of Global Crude Oil Reserves

Region/Group	% of World Proven Oil Reserves
Middle East	~66%
OPEC	~80%
OPEC+	~70% to 76%

National Perspective: National Security and Geopolitical Challenges of Energy Security

The following quotes directly tie Middle East oil protection to U.S. economic security and broader prosperity, making it a bipartisan and cross-administration strategic priority.

- "The pact was made that has endured for almost eighty years." **- Franklin D. Roosevelt (1945)**
- "...the U.S. is prepared to use armed forces to assist any nation or group of nations in the Middle East requesting assistance against armed aggression from any country controlled by international communism." **- Dwight D. Eisenhower (1957 - Eisenhower Doctrine)**
- "Let our position be absolutely clear: An attempt by any outside force to gain control of the Persian Gulf region will be regarded as an assault on the vital interests of the United States… will be repelled by any means necessary, including military force." **- Jimmy Carter (Carter Doctrine, 1980)**
- "Our country now imports nearly half the oil it consumes. That's why the Middle East is vital. This is not solely about securing oil, but the stability of the region and our economy depends on it." **- George H.W. Bush (Gulf War, 1991)**
- "Our overall objective is to remain the predominant outside power in the region and preserve U.S. and Western access to the region's oil." - Policy statement, developed by military planners including Paul Wolfowitz, Zalmay Khalilzad, and approved by Dick Cheney, illustrates the formal strategic importance of regional oil security for U.S. economic and security interests. "Of course it's about oil. We can't really deny that." - General John Abizaid (Former CENTCOM Commander, Iraq War)
- "We have secured the oil, and thus, a small contingent of US troops will stay in the area where the oil is located…. We are independent and do not need Middle East oil, but the Saudis and others must keep oil supplies flowing for world market stability. The U.S. is

taking action intended to bring Iran's oil exports to zero and deny the regime its principal source of revenue." **- Donald Trump (2019, 2020)**

- "We will ensure the free flow of energy from the region to the world. Although America is steadily reducing our own dependence on imported oil, the world still depends on the region's energy supply and a severe disruption could destabilize the entire global economy."**- Barack Obama (2013)**
- "We will not walk away and leave a vacuum to be filled by China, Russia or Iran… we will seek to build on this moment with active, principled, American leadership." **- Joe Biden (2022)**

In his second term, President Trump has pointed to OPEC+ (especially Saudi Arabia and its partners) as a major driver of global oil prices, citing their capacity to drastically cut or boost production, which can raise or lower global oil prices within weeks. When OPEC+ decides to cut output or fails to increase supply during shortages, Trump frames this as "manipulating the market" at the expense of U.S. consumers.

Table 32: Trump Administration's Statements About OPEC and Crude Oil Pricing

Reason	President Trump's Framing
OPEC+ output agreements and Saudi policy	***"Manipulating market, driving up prices"***
Geopolitical instability (e.g., Iran-Israel tension)	***"Middle Eastern chaos spikes oil prices"***
Energy as regional leverage (esp. Iran, Saudi Arabia)	***"Oil used as economic/political weapon"***

The Impact of Energy and National Security on Economic Security

The following is a summary of the history of U.S. oil price volatility and the relationship between price spikes and recessions.

- **Major oil price spikes:** At least six since the 1970s.
- **$100+ crude oil:** At least three distinct periods or events since 2008.
- **Recessions following oil price spikes:** 10 of the last 11 U.S. recessions were preceded by oil price spikes.

The Most Notable Oil Price Spikes Since the 1970s

- **1973–1974:** Arab oil embargo, prices quadrupled.
- **1979–1980:** Iranian Revolution and Iran-Iraq War, prices doubled.
- **1990–1991:** Gulf War, prices surged but for a shorter period.

- **2004–2008:** Strong global demand, geopolitical tensions, and supply disruptions, leading to a dramatic rise.
- **2011–2014:** Prices remained elevated due to Middle East tensions and strong demand.
- **2022:** Russian invasion of Ukraine caused prices to spike above $100 per barrel. [213] [214] [215]

Times Oil Surpassed $100 per Barrel

- **2008:** Prices peaked above $140 per barrel in July.
- **2011–2014:** Prices remained above $100 for much of this period.
- **2022:** Prices spiked above $100 again following Russia's invasion of Ukraine. [216] [217] [218]

Oil Price Spikes Followed by Recessions

- **Historical Correlation:** Nearly every major U.S. recession since World War II has been preceded by, or coincided with, a sharp increase in oil prices. [219] [220] [221]
- **Empirical Evidence:** Of the 11 U.S. recessions since 1947, 10 were preceded by oil price spikes (the exception being the 1960 recession). [222] [223] [224]
- **Recent Examples:** The 1973–1975, 1980, and 1981–1982 recessions were all preceded by oil price shocks. A major oil price spike also preceded the 2008 financial crisis (and associated recession). [225] [226] [227]

Impact of Energy Security on Personal Economic Security

Oil price spikes have well-documented impacts on inflation, interest rates, and gross national product (GNP) in the United States and other major economies. Oil price spikes raise inflation, prompt central banks to increase interest rates, and typically reduce GNP or GDP growth in the United States and other oil-importing economies. [228] [229] [230] The magnitude of these effects depends on the size and persistence of the price shock, as well as the economy's energy efficiency and the stance of its monetary policy.

However, these effects initially impact the individual due to increases in the prices of gasoline, home heating oil, food, groceries, credit card and mortgage interest rates, and job loss. All of these effects can also have a devastating impact on Maryland's budget as higher oil prices can increase spending (e.g., on energy assistance programs), reduce overall economic growth, which may lower other tax revenues (e.g., income and corporate taxes), and lead to tax increases and loss of services, or more likely both. Here's a summary of these effects:

Inflation

- **Direct and Indirect Effects:** Oil price increases directly raise energy prices, a significant input for production and transportation. This leads to higher costs for goods and services across the economy, pushing up both headlines and, to a lesser extent, core inflation.[231] [232] [233]

- **Empirical Estimates:** Studies show that every $10 per barrel increase in oil prices raises U.S. inflation by about 0.2 percentage points in the short run.[234] [235] A sharp spike—such as oil prices reaching $100 per barrel and remaining there for several months—can temporarily boost annual inflation by 1–3 percentage points before the effect fades as prices stabilize.[236] [237]
- **Second-Round Effects:** Higher energy prices can also indirectly raise food and core prices as businesses pass on increased costs, and consumers may adjust their inflation expectations. However, these effects are generally milder and more gradual in nature.[238] [239]

Interest Rates

- **Central Bank Response:** Central banks, like the U.S. Federal Reserve, typically respond to oil price-driven inflation by raising interest rates to prevent inflation expectations from becoming unanchored.[240] [241] [242]
- **Empirical Evidence:** The Federal Reserve often raises the federal funds rate within a few months after an oil price shock. For example, one study found that the Fed increases rates by about 60 basis points (0.6%) in the year following a significant oil price shock. [243] Other research indicates that a 6% increase in real oil prices results in a 20-basis point (0.2%) increase in the federal funds rate.[244]
- **ZLB Exception:** If interest rates are already at the zero lower bound (as during deep recessions), higher oil prices may not trigger rate hikes but can lower real interest rates due to increased inflation, potentially stimulating some sectors temporarily. [245]

GNP (Gross National Product)

- **Negative Impact:** Oil price spikes generally reduce GNP or GDP growth in oil-importing economies like the United States. For every $ 10-per-barrel increase in oil prices, the U.S. GDP is estimated to decline by about 0.5% if the higher price persists for a quarter.[246] [247]
- **Elasticity Estimates:** Recent elasticity estimates for the U.S. suggest that a 10% increase in oil prices reduces GNP by about 0.05–0.1% in the short run. However, the effect can be larger during major shocks.[248] [249]
- **Recession Risk:** Sustained oil price increases have historically preceded or coincided with U.S. recessions, as higher energy costs reduce consumer spending and business investment.[250] [251] [252]
- **Oil Exporters:** In contrast, oil-exporting countries may see a positive effect on GNP from rising oil prices, but this is not the case for the U.S.[253]

Table 33: Negative Economic Impacts from Crude Oil Price Spikes

Effect	Typical Impact of Oil Price Spike
Inflation	+0,2% per $10/bbl. (short run); up to +3% if severe
Interest Rates	+0.2–0.6% (central bank response)
GNP/GDP Growth	-0,5% per $10/bbl. (short run); recession risk

Context and Perspective

Maryland's dependence on global oil markets links its economy and security to geopolitical forces far beyond its borders. The dominance of OPEC+ in controlling global oil reserves, coupled with the historical pattern of recessions following price spikes, underscores the vulnerability of both the state and the nation to foreign energy shocks. At the same time, Maryland's network of military installations and supply infrastructure places it at the frontline of energy resilience. By expanding biofuel use, Maryland can help shield its economy from external manipulation, reduce the risk to household and state budgets, and contribute directly to U.S. national security readiness. This dual role—as both a consumer and a strategic producer—positions Maryland to turn a global vulnerability into a local strength.

Section 4: Environmental Security

Maryland's Environmental Security Challenges and Opportunities to Benefit from Biofuels

Strengthening Maryland's Economic Security and Climate Resilience

Increasing the volume/percentage of biofuels in gasoline and diesel fuel immediately reduces the carbon footprint of every gallon of fuel, directly lowering climate risks while strengthening Maryland's economy. Each additional gallon of biofuel replaces high-carbon petroleum, helping Maryland avoid billions in projected climate damage and safeguard its future.

- **Biofuels' Most Significant Challenge:** The most significant challenge to biofuels' economic opportunity in Maryland is the "indirect land use change: (ILUC) penalty, and the myth that biofuels increase greenhouse gas emissions. An ILUC penalty is an added carbon emissions factor applied to biofuels to account for greenhouse gases released when increased demand for biofuel crops causes new land (such as forests or grasslands) to be cleared elsewhere for agriculture, indirectly increasing global emissions.[254] [255] [256] This penalty is used in some regulations to reduce the climate benefits attributed to biofuels, reflecting the unintended environmental impacts of shifting land use patterns resulting from biofuel production.[257] [258] [259]
- **Baseline Data to Refute the Claim:** Ethanol has about 50% less carbon than gasoline.[260] [261] Biodiesel and renewable diesel reduce carbon emissions by 40% to 69% when produced from soybean, canola, and carinata oils, and 79% to 86% when converting tallow, used cooking oil, and distillers' corn oil. [262] In April 2025, a California Air Resources Board (CARB) study showed statistically significant reductions in emissions of particulate matter, carbon monoxide, total hydrocarbons, non-methane hydrocarbons, and carbon dioxide when switching from E10 to E15.[263]

Maryland faces growing physical, property, and economic threats from rising carbon emissions and accelerating climate change. With 82% of transportation-related greenhouse gas emissions coming from on-road vehicles, reducing the carbon intensity of liquid fuels is one of the most immediate and impactful strategies available. The Maryland Department of the Environment (MDE) estimates that unchecked climate change will impose $135B in total societal costs on the state through sea-level rise, flooding, storm damage, and economic disruption.

Maryland is uniquely vulnerable, with more than one million residents residing in coastal areas and nearly one in six jobs dependent on industries tied to the Chesapeake Bay and its waterways. Rising seas and stronger storms threaten homes, infrastructure, ports, farms, and the state's maritime economy. At the same time, the loss of farmland accelerates emissions. When agricultural land is converted to commercial or residential uses, the soil's carbon sequestration potential is destroyed and replaced by higher-emitting development. Between 2017 and 2022, Maryland lost more than 12,000 acres of farmland, further reducing resilience.

Biofuels offer a proven path to lower-carbon transportation. Ethanol emits approximately 50% less carbon than gasoline, while biodiesel and renewable diesel reduce emissions by 40–86%, depending on the type of feedstock used. Expanding biofuel use not only cuts transportation emissions but also sustains farmland, keeping soils in production and preventing high-carbon land conversion. These direct benefits counter flawed ILUC penalties by demonstrating that U.S. farmers are producing more on less land while preserving valuable agricultural acres.

The Farmland Loss "Double-Whipsaw" Carbon Effect

The data in the table below show the relative farm-stage carbon intensity (CI) for corn and soy (field production through harvest only; U.S. = 1.00 baseline), typical sustainability practices, and the "double-whipsaw" leakage risk if higher-CI producers displace U.S. output.

U.S. farm-stage CI is among the lowest globally due to very high yields, precision nutrient management, and conservation tillage—especially across the Corn Belt. If the U.S. cuts corn/soy output, two things happen at once, i.e., a "double-whipsaw":

Impacts & Outcomes

- If U.S. biofuel production and crop demand are curtailed, two carbon-intensive outcomes co-occur:
    - Domestic land commercialization (housing/retail/logistics) eliminates soil carbon sinks and raises U.S. emissions; **<u>and</u>** imports of agricultural products from higher-CI producers backfill demand, raising global emissions (and, for soy, elevating LUC risk in frontier regions).
- **Policy implication:** Keeping U.S. acres in productive, climate-smart agriculture (and channeling a larger share of output to biofuels) lowers transport CI while avoiding leakage and preventing high-carbon land conversion at home.

Table 34: Relative Farm-Stage Carbon Intensity Comparison

Region/Producer	Corn CI	Soy CI	Deforestation Risk (ILUC Penalty)	Risk if U.S. Feedstock Output Falls
United States (Corn Belt)	1.00	1.00	Low	High (domestic land commercialized + imports raise global CI)
Brazil	1.15–1.25	1.30–1.45	Medium–High	High (soy expansion, frontier risk)
Argentina	1.05–1.15	1.15–1.25	Medium	Medium–High
China	1.20–1.35	1.20–1.30	Low–Medium	Medium
EU	0.90–1.00	0.95–1.05	Low	Low–Medium
Canada	0.95–1.05	0.95–1.05	Low	Medium
Paraguay (soy)	—	1.30–1.50	High	High
Ukraine (corn)	1.10–1.25	1.15–1.25	Medium	Medium

Notes: Relative farm-stage CI comparison (U.S. = 1.00). Ranges are indicative and compiled from lifecycle/agronomy literature (e.g., GREET/Argonne, FAO, IPCC, peer-reviewed studies). Values reflect *farm-gate* emissions drivers (N fertilizer, tillage, diesel, residue management, on-farm energy) and exclude downstream processing/transport. Land-use change (LUC) risk is shown qualitatively.

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Impact: By displacing petroleum with biofuels, Maryland can cut the carbon intensity of its transportation sector, protect coastal communities and water-dependent jobs from climate impacts, and preserve farmland as a carbon sink. Preventing the "double-whipsaw" of losing U.S. acres to commercialization while importing higher-CI commodities is critical for climate stability. In this way, biofuels directly enhance environmental security while reinforcing economic, food, and energy resilience.

Loss of Farmland in Maryland Since the Start of the RFS

Maryland has faced significant farmland loss over the past two decades, driven by urbanization, policy challenges, and economic pressures. Between 2017 and 2022 alone, the state lost 12,086 acres of farmland, despite a net gain of 121 farms, indicating a shift toward smaller operations.[264] [265] This follows a longer-term trend: between 1959 and 2007, Maryland lost 41.7% of its farmland (1.4 million acres), with urbanization accounting for most of the conversions. While the rate of loss slowed in the early 2000s (from 1.2% in 2002 to 2007), recent data indicate persistent declines.[266]

Comparison to Other States

- **National context:** From 2017 to 2022, the U.S. lost over 20 million acres of farmland and 141,733 farms. Maryland's 12,000-acre loss in this period represents a smaller absolute amount but aligns with broader trends of consolidation and urbanization.[267] [268]
- **Historical ranking:** Over the last century, states like Tennessee and Indiana saw farm numbers drop by over 70%, driven by industrialization and larger-scale agriculture.[269] While direct 20-year rankings aren't provided, Maryland's challenges mirror those of states balancing suburban expansion with agricultural preservation.

Current Economic Impact

- **Annual losses:** Maryland farms lose $38.8 million per year to natural hazards like hurricanes, with an additional 23% drop in net farm income since 2022 due to inflation, labor costs, and weak crop prices.[270]
- **Policy pressures:** Commercial solar sitting on prime farming soil, high taxes, and regulatory burdens exacerbate financial strain.[271] [272]

Future Projections

If trends continue:

- **Land loss:** At the 2017–2022 rate (~2,400 acres/year), Maryland could lose 24,000 acres by 2035, threatening the state's agricultural critical mass.[273] [274]
- **Economic risks:** Continued decline may erode farm viability, especially for small operations. A 2007 study projected a 40,000-acre loss by 2010 (now outdated), highlighting the need for updated models.[275] Without policy intervention, annual revenue losses from development alone could exceed $ 7.4 million.[276]

Key Drivers

- **Urbanization:** Suburban expansion, particularly near Baltimore-Washington corridors, remains a primary threat.[277]
- **Market and regulatory pressures:** Weak commodity prices, environmental regulations, and labor shortages hinder competitiveness.[278]
- Maryland's agricultural future hinges on balancing growth with preservation, modernizing the Farm Bill, and addressing systemic economic challenges.[279]

Impacts

- **Economic Pressures:** Rising land prices (average $5,464/acre in 2023) and aging farmers (average age: 59.2) exacerbate barriers to entry.[280]
- **Food Security:** Loss of smaller farms threatens local food systems, while consolidation raises reliance on large-scale operations.[281]

- **Carbon Emission Increases:** Maryland's farmland loss reflects a national crisis but is intensified by its proximity to major urban corridors and limited state-level preservation policies.

Climate-smart agriculture (CSA) and farmland conversion to residential, commercial, or industrial uses have starkly different carbon intensity (CI) profiles. CSA practices reduce net emissions by enhancing carbon sequestration and lowering greenhouse gas (GHG) emissions. In contrast, land conversion typically increases emissions due to the loss of sequestration capacity and the energy-intensive development that accompanies it.

Climate-Smart Agriculture

CSA practices like no-till farming, cover cropping, and precision nutrient management reduce CI by:

- **Increasing soil carbon sequestration:** Larger-scale CSA projects (e.g., high-standard farmland remediation) boost carbon absorption by 0.131–0.774 t/ha during construction and achieve net-negative emissions post-construction, offsetting initial emissions within 5–10 years.[282] [283]
- **Lowering direct emissions:** Enhanced efficiency fertilizers reduce nitrous oxide (N_2O) emissions by 10–30%, and no-till practices cut diesel fuel use by ~15%.[284]
- **Providing scalable CI discounts:** For biofuels, CSA-adopted corn and soy receive CI reductions of 10 g CO_2e/MJ and 5 g CO_2e/MJ, respectively.[285] [286]

Farmland Loss and Conversion to Commercialization Increase Carbon Emissions

Converting farmland to low-density residential, commercial, or industrial uses increases CI due to:

- **Lost carbon sinks:** Farmland sequesters 0.5–2 t CO_2e/ha annually, which is eliminated upon conversion.[287]
- **Higher energy intensity:** Low-density residential areas emit 20–40% more GHG per household than urban infill development due to transportation, heating, and infrastructure (Data Gap. Need source old one is no longer available).
- **Construction emissions:** Land development generates 0.5–1.5 t CO_2e/ha from machinery, material use, and soil disruption.[288]

Table 35: Impact of Farmland Loss on Carbon Emissions

Factor	Climate-Smart Agriculture	Farmland Conversion
Net CI (t CO_2e/ha)	-0.2 to -1.5 (long-term sink)	+0.5 to +2.5 (annual emissions)
Time to break even	5–10 years.[289]	N/A (persistent emissions)
Co-benefits	Improved soil health and water quality.[290] [291]	None (ecological degradation)

CSA's carbon benefits are measurable and scalable, with larger projects showing greater emission reductions.[292] In contrast, land conversion irreversibly increases CI, making farmland preservation and CSA adoption critical for climate goals.[293]

ILUC Perspective and Comparative Analysis: Total Lifecycle Accounting for Fossil Fuels and War

Accounting for the Carbon Emissions Required to Protect World Oil Supplies

Suppose biofuel detractors believe ILU penalties should be included in EPA/DOE lifecycle analysis models. In that case, the greenhouse gas and other emissions of the U.S. military, which protect oil supplies, as well as the emissions from weapons discharged during conflicts, and the energy and materials used to rebuild those areas, must also be included. This alternative to biofuels involves more fossil fuel use. [294]

Models used for the annual UN negotiations on climate action to evaluate biofuels do not account for the lives lost in military conflicts or the direct and indirect emissions produced. According to researchers and climate advocates, the U.S. military is the world's largest institutional consumer of petroleum and producer of greenhouse gases. About 20% of the US military's annual operational emissions go towards protecting fossil fuel interests in the Gulf region – a climate change hotspot, warming twice as fast as the rest of the inhabited world.[295] [296]

Currently, the U.S. imports 7% of oil from Saudi Arabia and 15% from OPEC (i.e., OPEC+, which includes Russia). The U.S. and other countries will be dependent on oil for decades before the transition to alternative fuels is complete.[297] [298]

According to an estimate from the Cost of War Project, the US military produced around 1.2B tons of CO2 emissions between 2001 and 2017, with 400 million of those tons directly attributable to the post-9/11 wars in Afghanistan, Iraq, Pakistan, and Syria.[299]

Indirect Land Use vs Direct Farmland Lost

Since the passage of the Renewable Fuel Standard, farmers have been able to produce more on less land and with fewer inputs.

- Farmers planted an average of 322M acres per year (MMAPY) before the RFS and 318 MMAPY today.[300]
- From 2000 to 2023, farmland in the U.S. decreased by 66M acres.[301]
- From 2017 to 2022, Maryland lost over 12,000 acres of farmland.[302]
- The number of farms in the U.S. has decreased by 310,000 since the passage of the RFS.
- Between 2001 and 2016, 11M acres of U.S. farmland were converted to urban and commercial development—about 2,000 acres per day.

In 2008, after the Renewable Fuel Standard was passed, a few biofuel detractors claimed biofuels were worse than fossil fuels because of the "potential" impacts from "Indirect Land Use Change" e.g., forest land would be converted to farmland to produce more biofuel, billion gallons of ethanol, and 5B gallons of biodiesel later – the claim is still not valid.

Canada and Vermont do not consider the ILUC penalty in their assessments; the International Energy Agency may soon follow suit. Additionally, the IRS has eliminated the ILUC penalty in the new 45Z clean fuel production credit.

Biofuel Production Protects Maryland from the ILUC

If biofuel detractors shut down ethanol plants, farmers would need to plant an additional 5 million acres of corn and 15 million acres of soybeans to compensate for the loss of high-protein co-products used to increase the efficiency of animal feed.[303]

Section 5: Food Security

Biofuels Sustain Farmland, Food Prices, and the Environment

Food security is a cornerstone of **national security** and economic stability, sitting at the top of the hierarchy of needs and political priorities. While the U.S. has discovered alternative fuels, it has yet to discover alternative foods, making the preservation of farmland and the economic viability of farming essential.

Biofuel demand plays a critical role in sustaining the value of farmland by stabilizing corn and soybean prices. This stability allows farmers to continue producing more food and feed with fewer inputs, driven by productivity gains and technological advances. By creating reliable markets for crops, biofuels not only support **economic security** (through farm income and land values) and **energy security** (through domestic fuels) but also ensure long-term **food security** by preventing farmland loss, maintaining a resilient supply, and safeguarding against global price shocks. Sustaining farm prices enables continued investment in more efficient, environmentally sustainable agricultural practices, making biofuels a bridge between food, fuel, and climate resilience.

Key Insights

Biofuels support farmland value and stability.

- Demand from ethanol (corn) and biodiesel (soybeans) helps sustain crop prices.
- Higher crop prices are capitalized into land values, preventing farmland loss to commercial development.
- Studies show ethanol and biodiesel plants raise local farmland values by ~4% per 100M gallons of capacity.

Stable farm prices ensure long-term productivity and food security.

- Biofuel demand absorbs rising yields, allowing farmers to continue producing food, feed, and fuel.
- Sustained prices enable investment in climate-smart practices (e.g., no-till, cover crops, precision ag).
- Without stable prices, farmland loss accelerates, weakening U.S. food system resilience.

Energy and food security are interdependent.

- Producing domestic biofuels strengthens energy security while reinforcing stable agricultural markets.
- Reducing dependence on imported oil protects both farm economies and consumer food systems from global volatility.

- Energy and food resilience together safeguard Maryland's broader economic security.

Food security is a top priority for both politics and society.

- While fuel alternatives exist, no alternatives for food exist—making farmland preservation paramount.
- Stable crop prices reduce the risk of future supply shocks, especially during climate events, pandemics, or geopolitical instability.
- Supporting biofuels sustains a critical link between farmer prosperity, affordable food, and national stability.

The Reality of Maslow's Political Sustainability Hierarchy

Sustainable transportation policy must also be politically sustainable. Biofuels can first satisfy policymakers' basic survival needs. If environmentally focused policy champions can't meet their constituency's hierarchy of needs, they will not be able to continue in their role as champions.

- **Physiological** → **$**food, **$**water, **$**shelter, **$**sleep
- **Safety** → **$**security, **$**health, **$**stability
- **Love and Belonging** → friendship, family, community
- **Esteem** → respect, recognition, achievement
- **Self-Actualization** → personal growth, fulfillment

Impact

- The loss of farmland in the United States due to Environmental Security has complex but significant implications for consumer food, fuel, feed, and farmland prices, both now and in the future.

Food Security: Historical Context and Recent Trends

Over the past century, U.S. agricultural productivity has increased dramatically, resulting in a nearly 400% rise in total food production from 1929 to 2017, despite a decline of about 9% in cropland area.[304] This productivity growth has kept food prices stable or falling in real terms, despite a growing population and modest decreases in farmland. Most farmland loss in recent decades has been from pastureland, not cropland, with cropland declining by only about 2% since 1996. This means that the direct impact on staple food production has been limited so far.[305] [306]

Current Impact on Food Prices

Because agricultural productivity gains have outpaced the loss of farmland, Americans currently spend a smaller share of their income on food than people in most other countries.[307]

The farm share of the retail food dollar has declined, particularly in higher-income countries like the U.S., where agricultural production costs now account for less than half of total food prices.[308] This means that changes in farmland area have a muted effect on consumer prices compared to other factors, such as processing, transportation, and retail.

Future Risks and Scenarios

If current trends continue, millions more acres of farmland could be lost to development by 2040, particularly near cities where the most productive land is located.[309] This could undermine local food systems and reduce the resilience of the food supply, especially during disruptions such as pandemics or extreme weather events. In the long term, continued farmland loss—especially of high-quality, "Nationally Significant" land—could limit the U.S. agriculture's ability to respond to rising demand or supply shocks, potentially leading to higher food prices or increased reliance on imports.[310]

In high-income countries, the relationship between farmland loss and consumer food prices is not direct. Food prices are less sensitive to changes in agricultural production costs because these make up a smaller share of the final price. Even if producer prices rise due to farmland loss, the effect on consumer prices is generally smaller.[311] However, in a global commodity-driven market, a rising tide of prices in low-income countries will eventually create a rising tide of prices and geopolitical turmoil for all countries.

Table 36: Farmland Loss and Food Price Impact

Factor	Historical Impact	Current Impact	Future Risk if Loss Accelerates
Food production	Increased (due to productivity)	Stable	Potential decline (if loss is severe)
Consumer food prices	Decreased or stable	Low share of income	Could rise if supply tightens
Local food system resilience	High (with more farmland)	Still resilient	Lower resilience, higher vulnerability
Sensitivity to farmland loss	Low (so far)	Low	Higher if high-quality land is lost

Summary

To date, the loss of U.S. farmland has not led to significant increases in consumer food prices, mainly due to gains in farmer productivity and efficiency.[312] [313] [314]

However, continued or accelerated losses, especially of high-quality cropland near urban centers, could erode the resilience of the food system and eventually put upward pressure on food prices, particularly during supply disruptions due to changes in climate, increases in global demand, or trade policies that disrupt the free flow of commodities, or all the above. The ultimate impact will depend on future land-use policies, technological advances, and the balance between development and agricultural preservation.[315] Sustainable transportation polices could address each of the four challenges.

Biofuel's Impact on Soybean and Corn Prices, and Farmland Value Stability

The increasing demand for biofuels—including both biodiesel and ethanol—directly raises the demand and prices for key feedstocks, such as soybeans and corn, which are the primary crops used in U.S. biofuel production.[316] As biodiesel production expands, it drives a substantial increase in soybean oil demand—over 300% in the past decade—making it the fastest-growing sector for soybean oil demand.[317] [318] This heightened demand supports higher soybean prices, which is crucial for absorbing the rising yields and production of soybeans, helping to stabilize market prices even as output grows.[319]

Similarly, the growth of ethanol production has significantly increased demand for corn, with the ethanol sector now accounting for roughly 40% of total U.S. corn use.[320] This demand has helped support corn prices, especially during periods of high production, and has provided a critical market for U.S. corn farmers.[321]

Stable or rising prices for both soybeans and corn are essential for maintaining and enhancing farmland values, as higher commodity prices are capitalized into land values and farm incomes.[322] Research shows that the presence of biofuel plants can increase local farmland values by approximately 4% per 100 million gallons of plant capacity, reflecting the positive impact of robust biofuel demand on the agricultural economy.[323] Thus, sustained growth in both biodiesel and ethanol demand not only supports soybean and corn prices but also plays a key role in stabilizing farmland values amid increasing crop production.[324]

Fuel Ethanol's Impact on the Supply and Demand of Corn

While controversial for some, the need for corn prices to keep pace with the cost of farming and maintain the value of land is essential. There is an extensive literature that examines the relationship between food and biofuel prices.

Between 2005 and 2007, the first and second national renewable fuel standards were passed. Crude oil prices increased by as much as 75% during that period, and legislation was passed, along with targets for U.S. biofuel production.

Several studies have been conducted since 2018, providing a solid baseline of validated data. Although the different approaches used in the literature to assess the impact of biofuels on agricultural commodity prices, in particular corn prices, have produced diverse results, they do provide a consistent message. In particular, the literature suggests that the introduction of biofuel policies (e.g., the first Renewable Fuel Standard, or RFS, in the United States) between 2005 and 2007 was a significant contributor to the high commodity prices between 2008 and 2011.

The majority of the studies included in the 2018 Hochman and Zilberman meta-analysis. And a few ex-post studies (e.g., Hausman, Auffhammer, and Berck 2012.[325]) suggest that biofuels' effect on agricultural commodity prices was between 10 and 30 percent, with the impact depending on the period of analysis, the approach, and other factors (e.g., income changes) considered. Hochman and Zilberman (2018) found that the impact of biofuels was stronger in agricultural commodity markets than in markets for final consumer products; in the long term, biofuels were estimated to increase corn prices by an average of 14 percent.[326]

Data from an economic study released on September 15, 2025, show that providing consistent year-round access to E15 would add $25.8 billion to the U.S. gross domestic product, increase incomes by $10.3 billion, and support 128,000 additional full-time jobs. Of the $25.8 billion economic impact, $7.3 billion is associated with ethanol production, $13.8 billion comes from the corn needed to produce ethanol, and the remaining amounts are derived from exports and construction.

Summary.[327]

- Short-Run Effects: The expansion of corn ethanol production in the US has been linked to increases in corn prices, especially during the initial years of rapid growth.[328]
- Quantitative Estimates: On average, each billion-gallon increase in corn ethanol production is associated with a 2–3% increase in long-run corn prices. A 10% expansion in corn ethanol production typically results in a 2.4% increase in corn prices.[329]
- Local Effects: Ethanol plants can increase local corn prices by 5 to 20 cents per bushel, with effects that are felt up to 150 miles from the plant.[330]
- Long-Run Trends: Over time, the impact of ethanol on corn prices has moderated as the market adjusted, with increased crop productivity and changes in cropping patterns helping to stabilize prices.

Table 37: Maryland Corn Production, Prices, and Annual Loss at 14% Price Reduction

Year	Production (M bushels)	Average Price ($/bushel)	Price -14% ($/bushel)	Annual Loss ($)
2022	62.70	6.75	5.80	**60MM**
2023	72.60	4.40	3.78	**45MM**
2024	55.77	4.40	3.78	**35MM**

Key Points

- **Production:** Maryland's corn production ranged from approximately 55.8 to 72.6 million bushels per year over the past three years.

- **Average Price:** The average price per bushel was $6.75 in 2022 and $4.40 in both 2023 and 2024.
- **Price with 14% Reduction:** A 14% price decrease would lower the average price to $5.80 in 2022, $3.78 in 2023, and $3.78 in 2024.
- **Annual Economic Loss:** Maryland corn farmers' annual revenue loss is estimated to be approximately $59.6 million in 2022, $45.0 million in 2023, and $34.6 million in 2024.

Biodiesel's Impact on Soybean Demand, Prices, and Farmland

Increasing the demand for biodiesel directly increases the demand and prices for soybeans, as soybean oil is a primary feedstock for biodiesel production in the United States.[331] [332] As biodiesel production expands, it drives a substantial increase in soybean oil demand—over 300% in the past decade, making it the fastest-growing sector for soybean oil demand.[333] This heightened demand supports higher soybean prices, which is crucial for absorbing the rising yields and production of soybeans, helping to stabilize market prices even as output grows.[334] [335]

Stable or rising soybean prices, in turn, are essential for maintaining and enhancing farmland values, as higher commodity prices are capitalized into land values and farm incomes.[336] Research indicates that biofuel plants can increase local farmland values by approximately 4% for every 100 million gallons of plant capacity, reflecting the positive impact of robust biodiesel demand on the agricultural economy.[337] Thus, sustained growth in biodiesel demand supports soybean prices and plays a key role in stabilizing farmland values amid increasing production.[338] [339] [340]

The overall percentage impact of biodiesel production on the price of a bushel of soybeans is commonly cited as 13%. This reflects the added value for soybean farmers from increased demand for soybean oil in the biodiesel industry.[341] [342] [343]

Table 38: Impact of Biodiesel on Maryland's Soybean Production

Impact Area	Estimated Percentage Impact	Notes
Biodiesel demand	13% increase per bushel.[344]	Most widely cited figure
Removal of biodiesel policy	3.5–4.5% decrease.[345]	Based on economic modeling
Dollar impact	63 cents per bushel.[346]	Varies with market and policy conditions

Economic Impact of Biodiesel Production on Maryland Soybean Producers

- **Price Reduction**: A 13% decrease in the average price per bushel would lower prices to $12.56 in 2022, $11.37 in 2023, and $8.69 in 2024.
- **Annual Loss**: Maryland soybean farmers' annual revenue loss would be approximately $41.2M in 2022, $34.0M in 2023, and $26.0M in 2024.

Table 39: Potential Maryland Soybean Annual Income Increases

(Assumes a Transition to E15 and B20, Based on 2022–2024 Yields)

Year	Production (M bushels)	Average Price ($/bushel)	Price Increase with Biodiesel Demand (13% $/bushel)	Annual Gain OR Loss ($)
2022	21.93	14.44	12.56	41,166,996
2023	20	13.07	11.37	33,981,999
2024	20	9.99	8.69	25,974,000

Food Security: Indirect Land Use vs. Direct Land Loss

Since the passage of the Renewable Fuel Standard, farmers have been able to produce more on less land.

- Farmers planted an average of 322M acres per year (MAPY) before the RFS and 318 MAPY today (Transportation Energy Institute, 2024).
- From 2000 to 2023, farmland in the U.S. decreased by 66M acres (Shahbandeh 2024).
- From 2017 to 2022, Maryland lost over 12,000 acres of farmland (NASS 2024).
- The number of farms in the U.S. has decreased by 310,000 since the passage of the RFS (USDA/ERS, 2024).
- Between 2001 and 2016, 11M acres of U.S. farmland were converted to urban and commercial development—about 2,000 acres per day.

Context and Perspective

Food security is the foundation of both political legitimacy and societal stability. Unlike fuel, where technological alternatives exist, there are no substitutes for food—making farmland preservation and stable crop markets a national imperative. Biofuels help safeguard this balance by providing farmers with steady demand, reducing price volatility, and ensuring that agricultural systems remain strong enough to meet food needs even in times of climate stress, pandemics, or geopolitical disruption.

When viewed through Maslow's Hierarchy of Needs, the logic becomes even clearer. At the base of the pyramid, **physiological needs**—such as food, water, and shelter—must be met before higher needs can be addressed. Biofuels strengthen these fundamentals by sustaining farm incomes and preserving land for food production.

Moving upward, biofuels also support **safety** (energy security, health, and economic stability) and belonging (community resilience and rural prosperity). For policymakers, this means that they cannot credibly champion climate or environmental policies (**esteem** and **self-actualization** levels) unless they first ensure their constituents' basic needs for affordable food and secure energy.

By aligning food, fuel, and farmland preservation, biofuels provide not only an environmental solution but also a political strategy—anchoring higher-level policy goals in the unshakable base of human survival and security.

Section 6: Personal Security

Assessing the Impact of Maryland's Environmental Challenges on Personal Security and the Benefits of Increasing the Use of Biofuels

Personal Security: Linking Energy, Economy, and Everyday Stability

While national security concerns often dominate the discussion of global oil dependence, the most immediate and visible impacts are felt at the personal level. Energy price spikes raise the cost of gasoline, home heating oil, and electricity—forcing households to spend more on essentials and leaving less for food, housing, healthcare, and education. These shocks ripple outward, driving up inflation, raising credit card and mortgage rates, and increasing the risk of job loss during recessions. For Maryland residents, this translates into real threats to household stability, economic mobility, and quality of life.

Biofuels can play a direct role in shielding families from these vulnerabilities. By reducing exposure to volatile global oil markets, expanding local fuel alternatives, and stabilizing farm and energy prices, biofuels help secure not only Maryland's economy but also the personal security of its residents.

Key Insights

Table 40: The Economics of Personal Security and Biofuels

Impact Area	Key Data	Source
Toxic Exposure	Petroleum fuels emit benzene, toluene, xylene, and PM2.5, linked to asthma, heart disease, and premature death.	EPA, Health Effects Institute
Disproportionate Burden	Asthma hospitalization rates in Baltimore & Prince George's County are >2x the state average.	Maryland Department of Health, Asthma Surveillance Reports
Economic Cost	1% rise in PM2.5 = 11% increase in individual commercial health insurance expenditures	Currie & Walker, American Economic Journal: Applied Economics (2019)
Proven Benefits	California LCFS prevented thousands of illnesses/deaths and saved residents >$10B in avoided costs	CARB, LCFS Health Benefits Report (2021)
Opportunity & Impact	Expanding biofuel use in Maryland would cut toxic emissions, protect health, and enhance personal security.	Projection based on LCFS outcomes and Maryland adoption potential

Cleaner Fuel and Cleaner Air Saves Lives

Air pollution from petroleum fuels poses a direct threat to the personal security of every Marylander. Mobile-source air toxics—benzene, toluene, xylene, and fine particulate matter

(PM2.5)—drive higher rates of asthma, cardiovascular disease, and premature deaths, with health and insurance costs passed on to families and businesses. In Maryland, hotspots like Baltimore and Prince George's County bear disproportionate burdens, with asthma hospitalization rates more than double the state average. Studies show that a 1% increase in particulate pollution leads to an 11% increase in individual commercial health insurance expenditures.

Cleaner-burning biofuels displace these toxics, cutting emissions and health costs. California's Low Carbon Fuel Standard has already saved residents over $10B in avoided health and economic damage, preventing thousands of asthma attacks, heart attacks, and premature deaths. Expanding biofuel use in Maryland would replicate these benefits—while also reducing dependence on foreign oil, which fuels Middle Eastern conflicts, terrorism, and the national security risks that threaten Americans abroad and at home.

Key Insights

Health Care Costs Increase with Pollution Levels

- PM2.5 exposure in Baltimore is 37% above the state average; diesel pollution in Prince George's is 23% above average. For every 1% increase in PM2.5 concentration, the proportion of household expenditure on commercial health insurance to total income increases by 11.48%.[347]
- Pollution drives higher ER visits, hospitalizations, and premiums. For U.S. employer-sponsored insurance, a Health Affairs study uses employer claims to show air-pollution–related hospitalizations have substantial additional costs not captured in standard models (raising cost estimates by ~40% for respiratory and cardiovascular patients.[348]

Personal Security Risks and Costs

- Pollution causes 130 deaths per 100,000 residents annually in Baltimore—the highest in the U.S.
- Black children account for 88% of pediatric asthma hospitalizations tied to traffic pollution.
- Older adults face elevated risks, with PM2.5 contributing to ~50% of pollution-related Medicare costs. A 1 $\mu g/m^3$ increase in daily $PM_{2.5}$ significantly raises ER and inpatient spending among the U.S. elderly (Medicare), with detailed dollar estimates per million beneficiaries.[349]

Lessons from California

- LCFS reduced the fuel carbon intensity by ~13% and displaced 70% of diesel use.
- Over $10B in avoided health and societal costs by 2020.
- LCFS will prevent 38,000 asthma attacks, 600 heart attacks, and nearly 900 premature deaths.

Lessons from China

- The NBER working paper “The Morbidity Cost of Air Pollution” estimates that a 10 μg/m³ increase in $PM_{2.5}$ leads to about a 2.65 % increase in health-related transactions and 1.5 % increase in out-of-pocket medical spending in China.[350]

National Security Impacts Economic and Personal Security

- Presidents from Roosevelt to Biden have linked oil dependence to military commitments in the Middle East.
- The U.S. sends ~$59B annually to OPEC, indirectly funding conflict and terrorism.
- Approximately $81 billion per year is spent by the U.S. military protecting global oil supplies – about 16% of recent DoD base budgets.
- Reducing reliance on petro-dollars through biofuels enhances both personal and national security.

Opportunity & Impact

- No LCFS or biofuel incentives in place; major climate laws exclude ethanol entirely.
- Without policy change, Maryland forfeits billions in potential health and economic savings.
- Communities already facing environmental justice burdens will remain disproportionately harmed.

Maryland’s Environmental Security and Public Health Challenges

Maryland’s Advanced Clean Cars II Program

If Maryland’s Advanced Clean Cars II program (2027–2040) survives budget cuts, it would reduce PM2.5 by 585 tons and NOx by 5,978 tons, providing $604M/year in net health benefits by 2040. [351] Therefore, a transition to E15 and B20 would also provide significant health benefits, as data show that a transition to E15 and B20 can result in similar carbon and emission reductions, equivalent to removing over 900,000 vehicles from the road or adding 900,000 CAA II equivalent vehicles.

The potential impacts of climate change for Maryland residents living near Chesapeake Bay and the Atlantic Coast, and the effects of gasoline emissions on those living in urban areas, are of grave concern. Utilizing biofuels can play a crucial role in mitigating the costs and risks associated with floods, droughts, extreme weather events, vector-borne diseases, foodborne illnesses, food insecurity, infrastructure damage, fuel shortages, and public health concerns.

The two largest sources of GHG emissions in Maryland are:

- Transportation (35-36% of total emissions), with 82% of transportation emissions coming from on-road vehicles, which include light-duty vehicles (passenger cars, SUVs, and small trucks).[352]

- Electricity production and consumption (18-24%) is the second-largest contributor.[353]
    - Note: Approximately 40% of Maryland's electricity is imported from out of state [354] - 36% was coal-generated, peaking to 70% during specific intervals. [355]

In summary:

- Percentage imported: ~40%
- Main imported fuel: Coal (over 36%), along with natural gas and some nuclear.

Maryland's in-state electricity production relies on a diverse fuel mix, with the following approximate shares for 2024: [356]

- Nuclear: 41.2%
- Natural gas: 39.6%
- Coal: 6.9%
- Hydroelectric: 5.2%
- Solar: 3.1%
- Wind: 1.6%
- Biomass: 0.9%
- Petroleum: 0.6%
- Other: 1%. [357]

The Maryland Department of the Environment states that climate change and toxic emissions from gasoline can negatively impact several groups, particularly in terms of health and financial stability. Some groups are at greater risk than others, including, but not limited to, certain population sectors.

- Young children.
- Elderly 65 years old and older.
- older people who live alone.
- Communities are already stressed by environmental justice and health factors.
- Socially isolated people.
- Chronically ill people or people with respiratory diseases.
- People living in low-lying land areas.
- People who have low socioeconomic status.

Air pollution significantly impacts healthcare costs, contributing to higher premiums for both companies and individuals. Studies have shown a direct correlation between air pollution levels and increased healthcare expenses, particularly for respiratory and cardiovascular diseases. This leads to higher premiums as insurers factor in the increased risk of needing medical care due to pollution-related illnesses. The study reveals a strong positive correlation between air pollution and individual commercial health insurance expenses.

Environmental justice communities bear the highest burden of asthma and cardiovascular costs.[358] Approximately one in four people (24.1%) in Maryland reside in the Baltimore area or Prince George's County.

1. Older adults face elevated risks from PM2.5, which accounts for ~50% of pollution-related Medicare spending in comparable studies, driven by cardiovascular/respiratory admissions.[359] [360] [361] [362]
2. Cost-saving potential: Meeting federal air standards could reduce hospital spending by ~$193M over three years (California model), with Medicare likely seeing proportional savings in Maryland.[363]
3. **Baltimore**
    - PM2.5 air pollution is responsible for ~1.8M global deaths annually (2019 data), with Baltimore's exposure rates 37% above Maryland's average. Black children in Baltimore account for 88% of pediatric asthma hospitalizations, exacerbated by traffic pollution.[364]
    - PM2.5 exposure is 37% above the state average.[365]
    - Studies show 130 deaths per 100,000 residents annually in Baltimore due to long-term air pollution exposure, the highest rate in the U.S.[366] [367] [368]
    - Baltimore's asthma hospitalization rates remain at 2.3x Maryland's average, with PM2.5-exposed areas seeing higher ER visits.[369] [370]

- **Prince George's County:** Diesel pollution is 23% above average.

Federal Clean Fuel Standard Use Cases

The Clean Air Act Amendments of the 1990s' oxygenated fuel program and reformulated gasoline program, the Energy Policy Act of 2005, and the 2007 Renewable Fuel Standard all share a common fuel standard: to increase the use of biofuels to enhance economic, energy, environmental, and national security.

1990 Clean Air Act Amendments (CAAA)

- EPA projects that by 2020, CAAA programs will have prevented over 230,000 premature deaths and substantial morbidity—including thousands fewer cases of chronic bronchitis, heart attacks, emergency visits, asthma attacks, and lost school and workdays (US EPA).
- The public benefits—mainly from reduced premature mortality—exceed costs by a factor of 30 to 1, with even higher benefit-cost ratios at upper estimates (US EPA). Independent modeling (NRDC) projects annual economic benefits of $2.5–5.0 trillion by 2030, while avoiding hundreds of thousands of premature deaths, hospital admissions, and lost school days (Natural Resources Defense Council, NRDC).

Oxygenated Fuel Program (Carbon Monoxide Control)

- Required in CO "nonattainment areas," oxygenated fuels (with at least 2.7% oxygen [ethanol] by weight) improve combustion—especially in cold starts—thereby significantly reducing CO emissions and improving air quality (US EPA/U.S. Energy Information Administration).

Reformulated Gasoline (RFG) Program

- At least 2.0% oxygen [using ethanol or MTBE, the primary oxygenates] by weight had to be blended into RFG. Introduced in the 1990 CAAA, RFG burns cleaner than conventional gasoline. It has reduced mobile-source VOC emissions by 27%, NO_x emissions by 7%, and toxic pollutant emissions by 22% compared to conventional gas. (DEQ Virginia)
- Approximately 25% of U.S. gasoline is now RFG, protecting the air quality for ~75M people (US EPA).[371]

Renewable Fuel Standard (RFS)

- A federal policy mandating increasing volumes of biofuels—such as biomass-based diesel, cellulosic biofuel, and advanced biofuels—to replace fossil fuels in transport and heating (US EPA). By displacing gasoline and diesel, RFS reduces aggregate GHG emissions and fosters cleaner air while supporting rural economic development and agricultural commodity markets (US EPA).

Table 41: Clean Air Act & Fuel Programs – Outcomes at a Glance

Program	Health Benefits	Economic & Climate Benefits
1990 CAAA	Prevents 230,000+ early deaths by 2020; dramatic reductions in respiratory/cardiovascular events and lost productivity; benefit-cost ratio up to 30:1 (US EPA)	Annual benefits projected at ~$2.5–5 trillion by 2030 (NRDC)
Oxygenated Fuel (CO reduction)	Sharp reduction in CO, especially in wintertime; improved combustion reduces cold-start emissions (US EPA, U.S. Energy Information Administration).	Enhances safety and reduces short-term health risks.
Reformulated Gasoline (RFG)	Reduces smog-forming VOCs (27%), NO_x (7%), and toxic pollutants (22%). Protects ~75M people (DEQ Virginia, US EPA)	Improves air quality, reduces health-related costs.
Renewable Fuel Standard (RFS)	Supports reduced emissions by replacing fossil fuels.	Cuts GHG emissions; stabilizes agricultural markets; broad societal benefits (US EPA)

Key Insights

- The Clean Air Act Amendments of 1990, combined with fuel-specific programs, have significantly improved public health, prevented illness and death, and generated trillions in societal benefits—far exceeding program costs.
- The Oxygenated Fuel and RFG programs deliver targeted pollution reductions—especially in CO and smog—yielding widespread air quality improvements.
- The Renewable Fuel Standard strengthens environmental resilience by reducing fossil fuel dependence and linking agricultural and climate goals.

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California Clean Fuel Use Case

California Fuels Policies to Save State Residents over $10B in Health Care Costs

Background and Opportunity: California was the first state to implement a low-carbon fuel standard in 2001.

Biodiesel's Impact on the California LCFS: 75% of the diesel fuel in California is biodiesel or renewable biodiesel and accounts for 45% of the carbon credits generated in the state.

Ethanol's Impact on the California LCFS: All gasoline sold in the state adheres to this E10 standard. In 2024, California drivers consumed over 1.4B gallons of ethanol, reflecting a blend rate of approximately 10.7%—slightly above the national average. In 2024, California set a new record by consuming 114.7 million gallons of E85, marking the second consecutive year with sales exceeding 110 million gallons. This growth is supported by an expanding network of E85 fueling stations, with Pearson Fuels—the state's largest E85 distributor—operating over 350 sites and planning to reach 500 locations within the next 24 to 30 months. [372]

A report, *Driving California Forward*, from the Environmental Defense Fund and the American Lung Association in California provided a comprehensive analysis of the health and economic benefits of California's fuels policies under the voter-supported landmark climate law, AB 32. The bill aims to reduce the carbon intensity of transportation fuels by 30% by 2030 and 90% by 2045. The report analyzed the health and economic benefits of California's LCFS and cap-and-trade program. It is estimated that the LCFS would save Californians over $10B in health and societal economic costs by 2020. The report also highlights reductions in pollution-related health issues, such as asthma attacks and premature deaths, as well as decreased fuel consumption and greenhouse gas emissions. [373]

- With full implementation, the LCFS and C&T will result in cumulative benefits from avoided health costs, improved energy security, and reduced social costs of carbon valued $ at $10.4B by 2020 and $23.1B by 2025.
- By 2025, the health benefits of the LCFS and C&T will save $8.3B in pollution-related health costs such as avoided hospital visits and lost workdays. In addition, these policies will prevent 38,000 asthma attacks as well as 600 heart attacks, 880 premature deaths, and almost 75,000 lost workdays – all caused by air pollution.
- By 2025, California's LCFS and C&T will result in reduced consumption of 21.4 BGG and 11.8 BG of diesel fuel, meaning over $100B in reduced purchases at the pump.

California Air Resources Board's (CARB) November 8, 2024, Low Carbon Fuel Standard (LCFS) report states, The LCFS has been very effective to date, reducing the carbon intensity of California's fuel mix by almost 13% and displacing 70% of the diesel used in the state with cleaner alternatives. This has displaced 320 million metric tons of CO2 from gasoline and diesel emissions since the Program's inception. That's an amount equivalent to 85% of today's annual statewide greenhouse gas emissions. The growth in the use of renewable fuels is driving the necessary emissions reductions in the transportation sector. [374]

- "The proposal approved today strikes a balance between reducing the environmental and health impacts of transportation fuel used in California and ensuring that low-carbon options are available as the state continues to work toward a zero-emissions future," said CARB Chair Liane Randolph. "Today's approval increases consumer options beyond petroleum, provides a roadmap for cleaner air, and leverages private sector investment and federal incentives to spur innovation to address climate change and pollution."

The Pace to Cleaner Fuels is Accelerating

October 2024: California Governor Gavin Newsom directed the California Air Resources Board (CARB) to expedite its review of increasing the ethanol content in gasoline from the current 10%

(E10) to 15% (E15). This initiative aims to augment fuel supplies and alleviate high gasoline prices in the state. At that time, California was the only state limiting ethanol content in gasoline to 10%, whereas the rest of the United States permitted up to 15%. State officials estimate that adopting E15 could immediately increase California's gasoline supply by 5% to 10%, potentially leading to lower pump prices. [375]

April 2025: the California Air Resources Board (CARB) study shows statistically significant reductions in emissions from particulate matter, carbon monoxide, total hydrocarbons, non-methane hydrocarbons, and carbon dioxide when switching from E10 to E15. [376]

September 2025: The California Legislature unanimously passed AB 30, also known as the Cleaner Cheaper Fuel Blend Act, following Governor Gavin Newsom's directive to accelerate approval of E15 (gasoline with 15% ethanol). Once signed into law, the bill will allow the year-round sale of E15 in California, ending the state's prohibition on the blend. Supporters highlight that E15 could lower gasoline prices by up to 20 cents per gallon while reducing emissions and expanding consumer choice.

Section 7: Biofuels Stakeholder Database and Engagement Surveys

Responding to Maryland's Consumer Awareness and Public Education Challenge by Building a Larger Coalition of Biofuel Stakeholders and Advocates

Driving Consumer Awareness and Public Education

Public Education Public education is a priority, but awareness alone will not deliver market transformation. To turn knowledge into action, Maryland must expand the coalition of stakeholders who see biofuels as part of their own mission—whether that is lowering costs, protecting health, supporting farms, strengthening national security, or building a stronger economy. Like solving a Rubik's Cube, coalition building requires aligning many different perspectives to achieve a common goal: cleaner, safer, and more affordable fuels.

Summary

The challenge is clear: Maryland needs a broader, more unified base of biofuel supporters. Fortunately, public opinion and consumer trends already provide a strong foundation. National surveys indicate that 70% of U.S. consumers prefer to purchase from environmentally responsible companies, and Maryland residents are even more supportive of clean energy initiatives than the national average. This creates fertile ground for engaging a broad spectrum of stakeholders—from consumers, farmers, and truckers to environmental advocates, national security experts, and representatives from both major political parties.

The opportunity is to frame biofuels not as a niche alternative, but as a mainstream, bipartisan solution that benefits everyone. By highlighting biofuels as a cleaner, cheaper, safer, and immediately deployable fuel choice, Maryland can mobilize retailers, fleets, NGOs, farmers, and policymakers into a stronger coalition that reinforces public education and accelerates policy adoption. In short, building a larger coalition is not just about growing the tent—it is about ensuring that every Marylander sees a stake in the outcome.

Nationwide, a significant majority of consumers prefer to purchase sustainable products from companies with sustainability programs. A 2023 survey by Optimove found 70% of U.S. consumers consider it essential to buy from environmentally responsible companies, with 38% stating that being ecologically accountable is "very important" to their purchasing decisions.[377] Additionally, 64% of B2C marketers reported having an environmental responsibility program, and 62% actively promote their company's environmental initiatives in marketing campaigns.

Maryland residents have shown strong support for environmental initiatives, such as the state's commitment to achieving 100% clean energy by 2040 and the implementation of the Maryland Green Purchasing Committee, which encourages state agencies to procure environmentally friendly products. Therefore, public opinion on climate change, air pollution, and environmental justice in Maryland should make the development of safer, cleaner-burning gasoline and diesel important to gasoline retailers. Belief in climate change and support for government action are higher than the national average. [378]

Statewide:[379]

- 80% of Marylanders acknowledge climate change is happening (2024 survey), and 38% discuss climate change regularly.[380]
- 75% support state/local government action to protect communities from climate impacts. [381]
- 72% of adult Marylanders believe global warming is happening, and 69% are worried about it.
- 70% expect higher costs due to climate impacts.
- 73% of Baltimore-area residents fear personal harm from climate change.[382]

Maryland Demographic Overview for Public Campaign Planning

1. Educational Attainment

- Maryland ranks among the most highly educated states, with about 43.8% of residents aged 25 and older holding a bachelor's degree or higher, one of the top rates nationwide.
- Nearly 91.4% of Maryland adults have at least completed high school (Conduit Street).

2. Voter Participation & Engagement

- General Election Turnout (Eligible Voters):
  - 2024 Presidential: 69.3%
  - 2022 Midterms: 45.8%
  - 20-Year Average (2002–2024): 57.3%, notably above the U.S. average of 52.4% (Ballotpedia).
- **Registered Voter Turnout (General Elections):**
  - 2018: 59%
  - 2020: 75%
  - 2022: 49% Department of Legislative Services.
- 2024 Early Voting Trend: As of early November, approximately 37% of residents have already voted, driven by a substantial increase in both mail-in and in-person early ballots—suggested turnout may reach or exceed 80%, nearing historic highs (WYPR+1).

3. Politically Active & Civic-Minded Classification

- While specific data on "politically active" segments (e.g., participation in local forums, civic groups) aren't directly listed in these sources, the high levels of education and voter engagement suggest Maryland's populace is civically attentive and likely receptive to information-driven campaigns.

Key Insights

- A well-educated population offers fertile ground for nuanced messaging—especially around environmental science, cost-benefit framing, and long-term resilience.
- Relatively high voter turnout, particularly in presidential years, indicates that timely, election-aligned communications (e.g., right before early voting begins) can drive both awareness and political support.
- The rising trend in early voting and mail-in ballots suggests that multifaceted outreach—digital, informational mailers, and early engagement—could broaden your reach and impact.

The transition to higher blends of biofuels shows broad societal benefits for a range of stakeholders. Each group stands to benefit from reduced dependence on fossil fuels, increased biofuel adoption, and the resulting improvements in market, environmental, economic, and national security.

Table 42: Maryland Demographics Summary

Demographic Metric	Maryland Statistic
Bachelor's Degree or Higher	~43.8% of those 25+ years old Conduit Street
High School Diploma or Higher	~91.4% Conduit Street
Voter Turnout (2024 Presidential, eligible)	69.3% Ballotpedia
Midterm Voter Turnout (2022, eligible)	45.8% Ballotpedia
Avg. Voter Turnout (2002–2024, eligible)	57.3% Ballotpedia
Registered Voter Turnout Trends	2018: 59%, 2020: 75%, 2022: 49% Department of Legislative Services
2024 Early Voting & Mail-In	37% already cast as of early Nov WYPR+1

Table 43: Maryland Population Demographics

Demographic Interest	Demographic Audience	Description
Total Population	6.23M	**Digitally Connected.** **Educated:** 2nd highest national ranking. **Work for Federal Government:** Ranked 1st ~150K. **Watch the News:** 63% watch, 86% use smartphones/computers, 54% use social media, and 85% of those aged 65+ watch TV news.
Rural Development, food security	350,000	350,000 people work in agriculture in Maryland, including almost 6,000 full-time farmers. Agriculture is the state's largest commercial industry, contributing around $8.25 billion to the economy each year. Maryland's leading agricultural products are broiler chickens, dairy goods, corn, and soybeans.
Racing Enthusiasts	200,000	NASCAR has been using E15 since 2004, while Formula 1 uses E10. Additionally, there are several sustainable racing programs. Maryland has several race venues. Approximately 16% of Americans are NASCAR fans, and around 28% of American adults consider themselves Formula 1 fans – with 40% of those fans being female.
"Green" Purchase Preference	309,300 – 4M+	~85% of consumers considered "greener" in their purchasing habits, indicating a strong preference for sustainable or green products and a willingness to prioritize them when making buying decisions, with many even willing to pay more for such options. E85 and E15 are less expensive, and 309,300 flexible fuel vehicles are registered in Maryland. 71% of consumers prefer environmentally responsible companies.
Environmental Security	4.9M (80%)	86% of Marylanders believe climate change is happening (2010 data). 75% support the state government taking action. Less than 13% opposed government action. 41% of Americans identify as environmentalists, and 22% rate themselves as "strong environmentalists."
Environmental Justice	2.6M	Individuals who belong to a church are more likely to be supporters of environmental justice and public health protection initiatives. The Maryland population is 6.1 million, and 43.5% of the population belongs to a church.
Energy/National Security	460,000	Maryland is home to approximately 360,000 veterans and another 100,000 active-duty service members, Reservists, National Guard, and dependents.

Table 44: Biofuel Stakeholder Target Sectors

Stakeholder	Benefit	Explanation
Consumers	Better fuel prices, more food/fiber competition, stable supply	Ethanol lowers pump prices, diversifies fuel options, and supports food/fiber economies
Truckers/Fleet Operators	More stable, cleaner supply; cost savings	Biofuels mitigate price shocks from crude volatility and reduce toxic emissions.
Farmers	Stable markets, increased demand for farmland and crops	Biofuel production creates a steady demand for crops, supporting rural economies
Environmentalists	Lower toxic emissions, fewer greenhouse gases	Reduced fossil fuel use cuts mobile-source air toxics emissions, benzene emissions, and climate impact.
Hawks (Defense Advocates)	Less strategic dependence, reduced defense risks, and national security gains.	Lower oil dependence means less military involvement in protecting oil supplies.
Doves (Peace Advocates)	Fewer resource conflicts	Reduced oil wars and geopolitical tensions
Democrats	Environmental stewardship, public health, and job creation	Policy support for renewables aligns with climate action, environmental justice, and economic growth
Republicans	Free markets, rural prosperity, national security	Farm income, energy security, and less government subsidy distortion
Fuel Retailers	More supply choices, stable market, improved margins	Source diversification and policy incentives bolster supply and consumer options
Animal Feed Operations	Increased supply of high-protein feed from biofuel coproducts	Ethanol byproducts (e.g., distillers' grains) supply livestock/feed markets

Cheaper, Better, Faster, Safer Driven Markets

Modern free markets across multiple sectors have evolved from monopolies or limited options to diverse, consumer-driven choices—providing greater value, convenience, transparency, features, and sustainability. Market access and technological advances in every industry—from energy to food, telecom to insurance—turn limited, monopoly conditions into highly competitive consumer-driven landscapes.

- Increasing the use of biofuels is <u>another</u> cleaner fuel consumer choice. The choice is <u>in addition to</u> pursuing more EV options – not instead of, or as an alternative to, any other fuel option.
- There are no worthwhile reasons not to make gasoline and diesel fuel cleaner.
- Outcome: Reduce emissions from every gallon of fuel in every vehicle, every day, for every person in Maryland.

Table 45: Examples of Cheaper, Better, Faster, Safer Products Increasing Market Share at Higher Prices

Category	Baseline / Low-Cost Option	Premium / Higher-Cost Option	%/Multiple Higher	Value Drivers	Competitors
Drinking Water	Tap water (<$0.01/gal)	Bottled water ($8–$16/gal), sparkling/filtered systems	100x+	Safety, purity, convenience, brand image	Bottled spring water, filtered water systems, sparkling/flavored water
Organic Food	Conventional apples $1.50–$2/lb.	Organic apples $3–$4/lb.; plant-based meat $8–$10/lb. vs. $3–$4/lb. beef	50–100% more	Health, sustainability, farming practices	Organic, local, non-GMO, plant-based, functional/supplemented foods
Automobiles	Gas sedan $25k	Hybrids/EVs $35k–$55k; Luxury EVs $60k+	1.5–3x	Sustainability, tech, brand, safety	Ford, GM, Toyota, Honda, Tesla, Rivian, hybrids, gas, EVs
Vehicle Safety	Standard seat belts (included)	Advanced safety tech $2k–$5k; luxury safety $10k+	Thousands more	Protection, peace of mind, insurance savings	Airbags, cameras, lane assist, AEB, blind spot warning, and advanced crash protection
Beer	Domestic 12-pack ~$10	Craft/microbrew 6-pack $15–$20; imports $8–$12/pint	2–3x	Taste, variety, authenticity, and cultural value	Import, craft, light, regular, non-alcoholic, local microbrews
Mobile Phones	Landline $20–$30/month	Smartphone plan $80–$120/month + $1k device; iPhone 30–50% premium	3–5x	Connectivity, apps, brand identity	AT&T, Verizon, T-Mobile, Google Fi; Skype, WhatsApp, VoIP
Television	Free antenna TV	Cable/streaming bundles $100–$200/mo. + add-ons	100–200x	Variety, personalization, and on-demand convenience	Cable, DirecTV, YouTube TV, Netflix, Hulu, Disney+, Roku

Table 46: Examples of Cheaper, Better, Faster, Safer Products Increasing Market Share at Higher Prices

Category	Baseline / Low-Cost Option	Premium / Higher-Cost Option	%/Multiple Higher	Value Drivers	Competitors
Internet/Comms	Basic local service	Fiber/5G, app-based video (Zoom/Teams)	2–5x	Speed, coverage, features	Fiber, cable, wireless, satellite, 5G, Zoom, Teams
Soft Drinks	Tap water (free)	Soda $1–$2; craft soda/kombucha $3–$5	2–3x	Taste, health, lifestyle branding	Craft soda, energy drinks, sparkling water, kombucha, zero/calorie/functional
Air Travel	Basic economy $200 RT	Premium $1k–$3k RT; private 20–50x	5–50x	Comfort, time savings, loyalty perks	Multiple airlines, global/national carriers, low-cost, premium, hubs/choices
Ride-Sharing	Taxi $10–$15	Uber/Lyft $20–$50; luxury rides $100+	2–10x	Convenience, transparency, flexibility	Uber, Lyft, local competitors, pooled/shared rides, luxury/private
Insurance	Agent office only	Aggregators, online services, app-based comparison	2–3x more options	Cost savings, choice, convenience	Aggregators, online services, app-based comparison
Food Proteins	Beef, chicken, pork	Plant-based (Impossible, Beyond), organic/local, lab-grown	50–100% more	Dietary needs, sustainability, ethical alternatives	Impossible, Beyond, organic/local, lab-grown

Maryland Biofuels Task Force Stakeholder Database

The Maryland Biofuels Task Force developed the Maryland Biofuels Task Force Stakeholder Database to collect data to support research.

- Maryland Biofuels Task Force (50+): Companies, organizations, government, Nongovernmental organizations (NGOs), and academia.
- Fuel Ethanol and Biodiesel Stakeholders: Producers, users, and technology developers.
- Related Nongovernmental organizations (100+): Environmental, environmental justice, public health, agriculture, clean energy, economic development.
- Fleet Administrators (100+): Government and commercial.
- Fuel Retailers (100+): Gasoline, diesel, alternative fuel.

- Industry Sectors (200+): Trucking, rail, airport, port,
- Media (400+): Conventional and trade media.

Data from Task Force Stakeholder Surveys

Maryland Biofuels Task Force Consumer Awareness Survey MACo 2025 Summer Conference

Maryland consumers surveyed in the 2025 Biofuels Task Force Study generally lacked awareness of key biofuels benefits, with the majority expressing unfamiliarity and indifference to economic, environmental, and health impacts of increased biofuels use. Most respondents were not previously informed about topics such as price savings, carbon reductions, and supply chain benefits from biofuel policies, and many remained unconcerned even after being educated through survey questions.

Key Findings: Areas Consumers Did Not Know or Did Not Care

Across almost every question, 60–90% indicated they were not aware of the benefits related to biofuels before the survey.

- For economic topics like fuel price savings from E15, as many as 85% were previously unaware, and some indicated apathy after learning about it.
- None of the 20 respondents were previously aware that biomass-diesel production contributed to lower diesel prices; all indicated a lack of prior knowledge, and some showed indifference.
- 80–90% lacked prior awareness regarding farmland value, carbon emission reductions, and food security benefits of biofuels..
- On health impacts (like avoided asthma symptoms and healthcare costs), nearly all respondents were unaware.
- Environmental facts (e.g., biofuels' lower carbon intensity and air pollution reductions) saw 75–90% "not aware" rates, with a fraction continuing to "not care" post-survey.
- Overall, the survey revealed a significant consumer knowledge

Figure 6: Lack of Consumer Awareness and Public Education

gap and some persistent indifference regarding biofuels' multi-sector impacts, which could present challenges for policy adoption and education efforts.

- Estimated completion rate 70% and time to complete 8 minutes. https://www.surveymonkey.com/r/5HGKR65

Maryland Fuel Retailer Stakeholder Engagement Survey

The Maryland Fuel Retailer Stakeholder Engagement Survey is designed to gather feedback from fuel retailers across the state regarding their experiences, challenges, and opportunities related to offering higher blends of biofuels, such as E15/E85 and biodiesel (B5–B100), at retail, private, and government refueling stations. The survey aims to identify market demand, technical and regulatory barriers, and incentives that could help retailers expand their biofuel offerings, enabling the Maryland Biofuels Task Force better to support statewide economic, environmental, and energy goals.

Survey Sections Overview

- Current Offerings and Interest: Asks retailers about the types of biofuels and alternative fuels currently offered, perceived demand from customers, and actions taken or considered regarding state/federal grants or infrastructure additions.
- Motivations and Perceptions: Gauges the importance of factors like environmental benefits, customer demand, pricing, incentives, and regulations in influencing decisions to offer higher blends of biofuels, as well as retailers' likelihood of future investment.
- Challenges and Barriers: Identifies logistical, financial, technical, and regulatory obstacles that may hinder expansion of biofuel infrastructure and asks retailers to rank them in order of significance.
- Feedback (Challenges and Recommendations): Invites retailers to provide recommendations, policy suggestions, and ideas for incentives or support that could make biofuel infrastructure investments more attractive and feasible.
- Contact & Community Engagement: Requests retailer contact information for future outreach and gives the option to join or opt out of ongoing Task Force community engagement efforts.
- Estimated completion rate 55% and time to complete 9 minutes. https://www.surveymonkey.com/r/G82WVB5

Maryland Biofuels Task Force D.R.I.V.E. Quiz

The Maryland Biofuels Task Force D.R.I.V.E. Quiz is designed to educate Maryland drivers while gathering insights into their understanding of the economic, energy, environmental, and health impacts of fuel choices, with a specific focus on biofuels. Conducted as an engaging 21-question quiz, it highlights how fuel decisions affect the state's economy, environment, and public health.

Survey Sections Overview

- Introduction and Purpose: Explains the D.R.I.V.E. (Drive Responsibly and understand the Impact and Value of Economic, Energy, Environmental, and Personal Security) concept and the quiz's goal to educate and invite public participation.
- Economic Security Questions: Assesses knowledge about fuel cost savings, benefits of biofuels for rural economies, and biofuels' impact on local market stability.
- Energy Security Questions: Tests the understanding of Maryland's reliance on imported fuels, vulnerabilities to disruptions, and the role of biofuels in increasing local fuel security.
- Environmental Security Questions: Focuses on the potential of biofuels to lower carbon emissions, helping achieve climate goals and air quality improvements from higher biofuel blends.
- Personal Security Questions: Evaluates awareness of health impacts—such as reduced carcinogens and improved air quality—and cost savings linked to biofuel use.
- Bonus and Engagement: Multiple-choice about fuel retailer options, followed by prompts for contact info and options to join or opt out of future Task Force stakeholder activities.
- Estimated completion rate 66% and time to complete 3 minutes. Link to take the survey https://www.surveymonkey.com/r/YZTJ5JV

Maryland Biofuels Task Force Fuel Ethanol Stakeholder Engagement Survey

The Maryland Biofuels Task Force Fuel Ethanol Stakeholder Engagement Survey gathers feedback from stakeholders involved in the production, distribution, and use of fuel ethanol in the United States to identify and prioritize key challenges facing the industry. With input from a diverse set of respondents—including residents, government officials, nonprofits, academia, and industry operators—the survey ranks issues related to policy, infrastructure, market dynamics, technology, and public education to inform future actions and support efforts to expand the role of ethanol in Maryland's energy mix.

Survey Sections and Key Data

- Challenges Ranking: Respondents ranked major barriers such as federal and state policy uncertainty, feedstock challenges, infrastructure limitations, market volatility, technological challenges, vehicle technology issues, public education gaps, and global market dynamics.
- Top-ranked barriers include federal policy/regulatory uncertainty, insufficient state Low Carbon Fuel Standards, feedstock availability/price volatility, and limited infrastructure for higher ethanol blends.
- **Federal Policy Details:** Prioritized issues included EPA's E15 waiver restriction, low Renewable Fuel Standard volume obligations, high small refinery exemptions, and the sunset of the 45Z tax credit.
- **State Policy Details:** Challenges cited were insufficient state LCFS, lack of minimum octane/biofuel requirements, carbon credit policy limitations, and indirect land use change penalties.
- **Feedstock Issues:** Concerns focused on the volatility and availability of feedstocks, carbon intensity regulations, and limited financial support for farmers to adopt climate-smart practices.
- **Infrastructure Limitations:** Main obstacles were the limited availability of higher ethanol blends for fleets and insufficient infrastructure for transport, storage, and delivery.
- **Market Volatility:** Respondents identified regulatory uncertainty, tight profit margins, subsidized fossil fuel competition, and fluctuating value of carbon credits as pressing concerns.
- **Technology Challenges**: Needs highlighted include improved catalytic processes, continual production advances, carbon capture, utilization, and storage, and lifecycle certification of advanced biofuels.
- **Vehicle Issues:** Barriers include a lack of engine optimization, reduced automaker CAFE credits for flex-fuel vehicles, and insufficient real-world emissions testing for higher ethanol blends.
- **Public Education:** Limited consumer, policymaker, and fleet administrator awareness and confidence were cited as critical gaps for market growth.
- **Global Dynamics:** Stakeholders worried about competition from imports, shifting policies, supply-demand imbalances, and a lack of unified sustainability standards.
- **Stakeholder Perspectives & Engagement:** Respondents represented various sectors and many expressed interests in ongoing engagement, with several providing contact information for updates.
- Estimated completion rate 62% and time to complete 7 minutes. Link to take the survey https://www.surveymonkey.com/r/YZTJ5JV

Survey Data Analysis

The Maryland Biofuels Task Force Fuel Ethanol Stakeholder Engagement Survey reveals that stakeholders rank federal and state policy uncertainty, feedstock challenges, and infrastructure limitations as the most significant barriers to increasing fuel ethanol production and use, with additional concerns about market volatility, technology needs, and lack of public education. Respondents represented a cross-section of industry, government, nonprofit, and academic perspectives, consistently underscoring the necessity for stable regulations, support for technical advancements, and improved consumer awareness to unlock further growth in Maryland's ethanol sector.

Key Insights from Stakeholder Feedback

- **Policy and Regulatory Uncertainty:** Federal challenges like EPA's E15 waiver, low Renewable Fuel Standard (RFS) volume obligations, and high small refinery exemptions were the most frequently ranked top barriers, alongside state concerns about insufficient Low Carbon Fuel Standards and lack of required octane/biofuel content.
- **Feedstock and Infrastructure:** Volatility in feedstock availability and price, carbon intensity regulations, and limited financial support for farmers all constrain supply; stakeholders also cited a lack of infrastructure for distributing and using higher ethanol blends, especially for government and commercial fleets.
- **Market Dynamics:** Respondents highlighted the vulnerability of ethanol production to regulatory uncertainty, subsidized fossil fuel competition, and unstable value of carbon credits as critical threats to plant viability and investment.
- **Technology and Vehicle Issues:** Calls for process improvements, next-generation biofuels, and carbon management were common, with a notable emphasis on incentivizing engine optimization for higher ethanol blends and restoring flex-fuel vehicle manufacturing incentives.
- **Education Gaps:** Low consumer, policymaker, and fleet administrator awareness and confidence stand out as major public education challenges, with stakeholders recommending expanded campaigns to drive demand and acceptance.
- **Global Competition:** Import competition, shifting policy, and lack of unified international sustainability standards further complicated stable market access for domestic producers.

These findings suggest that advancing fuel ethanol in Maryland will necessitate multifaceted action in policy, infrastructure, technology, market development, and public outreach.

Maryland Biofuels Task Force Biomass-based Diesel Stakeholder Engagement Survey

The Maryland Biofuels Task Force Biomass-based Diesel Stakeholder Engagement Survey was developed to collect feedback from professionals and stakeholders across the biofuels value chain, identifying and prioritizing the greatest challenges to expanding the production and use of biomass-based diesel in the United States, including Maryland. The survey features a ranking of barriers in federal policy, production, infrastructure, market forces, technology, vehicle compatibility, public education, and global trade, to inform Task Force analysis and shape future recommendations.

Survey Sections Overview

- **Challenge Ranking:** Respondents order significant barriers such as federal and state policy uncertainty, feedstock supply, infrastructure limitations, market volatility, and technology obstacles affecting biomass-based diesel.
- **Federal Policy and Regulatory Uncertainty:** Participants rank issues like Renewable Fuel Standard volumes, the 45Z Clean Fuels Producer Tax Credit, Indirect Land Use Change (ILUC) penalties, and fossil fuel subsidies.
- **State Policy and Regulatory Uncertainty:** Focuses on deficiencies in state Low Carbon Fuel Standards (LCFS), carbon credit policies, and ILUC limitations for crop-based feedstocks.
- **Feedstock Challenges:** Examines the impact of feedstock price volatility and carbon intensity regulations, often relating to Climate Smart Agriculture.
- **Infrastructure Limitations:** Looks at product availability for fleets and gaps in transport, storage, and blending infrastructure for higher diesel blends.
- **Market Volatility:** Prioritizes regulatory uncertainty, capital requirements, profit margin pressures, subsidized fossil fuel competition, and the value instability of carbon credits.
- **Production Technology Challenges:** Addresses lifecycle certification requirements, needs for better catalysts, and ongoing improvements, alongside calls for advanced biofuels and carbon capture adoption.
- **Vehicle Technology Challenges:** Identifies lack of manufacturer flex-fuel support, cold-weather performance issues, and incentives for new technology adoption.
- **Public Education Challenges:** Ranks limited awareness and confidence among consumers, policymakers, and fleet administrators.
- **Global Market Dynamics:** Considers competition from imports, supply-demand imbalances, policy shifts, and insufficient international sustainability standards.

- **Stakeholder Information & Engagement:** Gathers stakeholder category information and allows respondents to opt into receiving more updates from the Task Force.
- The estimated completion rate 62% and the time to complete is 7 minutes. Link to take the survey: https://www.surveymonkey.com/r/PGXY7BT

Data Analysis

The Maryland Biofuels Task Force Biomass-based Diesel Stakeholder Survey results indicate that stakeholders view federal policy and regulatory uncertainty, feedstock availability and price volatility, and infrastructure limitations as the main obstacles to expanding biodiesel production and use in the U.S. and Maryland. Feedback highlights that overarching market forces—including regulatory and capital challenges, lack of blending incentives, and global competition—remain critical impediments, with respondents also identifying gaps in technology development and community awareness that must be addressed for sector growth.

Key Insights from Biodiesel Stakeholder Feedback

- **Federal & State Policy:** The highest-ranked concern was uncertainty surrounding federal policies like Renewable Fuel Standard volume obligations, tech-neutrality for producer tax credits, and indirect land use change (ILUC) penalties; at the state level, lack of low-carbon fuel standards and suitable incentives were prevalent.
- **Feedstock Issues:** Stakeholders consistently cited feedstock availability and price volatility as the number one barrier, followed by concerns about carbon intensity regulations for Climate Smart Agriculture.
- **Infrastructure Barriers:** Limited product availability for fleets and insufficient infrastructure for higher diesel blends were commonly ranked as major obstacles, with stakeholders recommending blending incentives as part of solutions.
- **Market Volatility:** Regulatory uncertainty, narrow profit margins, and subsidized fossil fuel competition threaten plant investment and viability, while fluctuations in carbon credits add further instability.
- **Technology & Vehicles:** Improvement needs were identified in production processes, yield, and lifecycle certification; uncertainty around manufacturer support for high-biodiesel blends, performance in cold weather, and lack of flex-fuel incentives were also noted.
- **Public Education:** Limited consumer, policymaker, and fleet administrator awareness undermines confidence in biodiesel adoption and market development.
- **Global Market Dynamics:** competition from imports, shifting policy landscapes (such as tax credit restrictions), and lack of unified sustainability standards were noted as tightening domestic supply and limiting sector expansion potential.

Overall, these results underscore that the combined challenges of policy, supply chain, market structure, technology, and awareness must be systematically addressed to foster growth in Maryland's biodiesel sector.

The Maryland Biofuels Task Force Fleet Administrator Engagement Survey

The Maryland Biofuels Task Force Fleet Administrator Engagement Survey aims to gather input from Maryland fleet managers to understand better current fleet practices, alternative fuel adoption, and the specific needs and barriers associated with increasing biofuel usage in public, private, and commercial fleets throughout the state. The survey's goals are to inform state strategies for energy security and sustainability, enhance policy and incentive development, expand refueling and vehicle options, and ensure fleet voices are considered in funding and infrastructure planning.

Survey Sections

- **Current Offerings and Interest:** Assesses how fleets refuel, types of alternative fuel vehicles currently in the fleet, fleet size and vehicle classes, compatibility with higher biofuel blends, annual fuel consumption, and past grant applications for biofuel infrastructure.
- **Strategic Planning and Policy:** Explores whether fleets have written strategic plans or sustainability officers, ESG goals referencing fleet fuels, the impact of funding/policy changes, and regulatory compliance (EPACT, etc.).
- **Infrastructure and Investment:** Covers existing on-site fueling infrastructure, interest in expanding fueling options, helpful forms of assistance (financial, technical, permitting), and preferred types of support for biofuel infrastructure investment.
- **Challenges and Barriers:** Probe how easy it would be to use more biofuels, which barriers are most limiting (vehicle cost or availability, fuel supply, pricing, infrastructure, and regulatory hurdles), and ask respondents to rank specific challenges.
- **Feedback (Recommendations & Opportunities):** Collects recommendations for increasing biofuel use, additional comments or challenges, top recommendations for policymakers and industry, as well as contact information for follow-up or opting out of future engagement.

  The estimated completion rate is 54% and the time to complete is 13 minutes. Link to take the survey: https://www.surveymonkey.com/r/LFJ56SX

Section 8: Biofuel Fundamentals

Assessing the Performance, Compatibility, Availability, Emissions, and Supply Chain for Biofuels

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Context: *What do the CAAA, Oxygenated Fuels Program, Reformulated Gasoline Program, and Energy Policy Act's renewable fuel standard have in common?*

Perspective: *A biofuel standard.*

Performance, Compatibility, Availability, Emissions, and Supply Chain

Fuel Ethanol

Fuel ethanol is ethyl alcohol produced by fermenting sugars and starches from crops such as corn and sugarcane, commonly used as a gasoline additive to reduce emissions and support renewable energy.

Key Properties

- Renewable: Produced from biomass such as corn, sugarcane, or cellulosic materials.
- Liquid: Clear, colorless alcohol used as a motor fuel, or "oxygenated fuel" blending component.
- Gasoline Blending Levels: Common blends include E10 (10%), E15 (15%), E20 (20%), and E85 (85%) ethanol in gasoline.
- OEM Acceptance: EPA approves all vehicles at 10% and all vehicles manufactured after 2001 for 15%. 20+ M vehicles can use up to 85%

Octane Enhancement

- Adding ethanol raises octane ratings (resistance to engine knock), especially at 10%, 15%, 20%, or 85% blends.
- High-octane ethanol blends can help engines operate cleaner and more efficiently.

Table 47: Ethanol's Octane Rating and Impact on Gasoline Blendstock

Ethanol Blend	Typical Octane Rating	Increase over Baseline*
E10 (10%)	87–94	+2 to +3 points
E15 (15%)	88–98	+3 to +4.5 points
E20 (20%)	98	+4.5 to +5 points
E30 (30%)	99–100+	+5 to +7 points
E85 (85%)	100–105, up to 113	+10 to +20 points (varies by base)

Federal Gasoline Standards Compliance

Ethanol is the primary "oxygenated fuel" used to meet oxygenated fuel, reformulated gasoline, and renewable fuel standards set to reduce vehicle emissions and foreign oil reliance.

Ethanol provides the required "oxygen" content for cleaner, more complete combustion, thereby reducing pollutants and mobile-source air toxics by reducing the amount of BTEX in gasoline.

Table 48: Ethanol and BTEX Octane Enhancer Comparisons

Property	Benzene	Toluene (Methylbenzene)	Ethylbenzene	Xylene (Dimethylbenzene)	Ethanol (Benzene Free)
Research Octane Number (RON)	~101	~114	~108	~117	~109
Motor Octane Number (MON)	~95	~100	~100	~101	~90–100
Anti-Knock Index (AKI)	~98	~107	~104	~109	~99–104
Toxicity	**High** (carcinogen)	Moderate	Moderate	Moderate	Low
Volatile Organic Compound (VOC)	Yes	Yes	Yes	Yes	No
Greenhouse Gas Impact	Contributes	Contributes	Contributes	Contributes	Reduces
Renewable	No	No	No	No	Yes
Water Solubility	Low	Low	Low	Low	High
Oxygen Content	0%	0%	0%	0%	~35%

Fuel, Feed, Fiber, and Biobased Product Production

Food, Feed, Fuel, and Fiber

Ethanol production from grains involves separating starch from protein—typically through wet milling or advanced separation processes—so that starch is fermented into ethanol. In contrast, the protein part becomes a co-product for animal feed.

Starch and Protein Separation

The starch is isolated from grains, such as corn, using processes like wet milling, which separates kernels into starch, fiber, oil, and protein components. After separation, the starch undergoes hydrolysis and fermentation to produce ethanol.

High-Protein Animal Feed Byproducts

The protein-rich residue, mostly in forms such as distillers grains or corn gluten meal, is highly concentrated and used in livestock diets to enhance feeding efficiency. These co-products provide more available protein, energy, and minerals than raw grains, thereby improving the growth, health, and feed conversion in animals raised for food.

Figure 7: Ethanol Production: Turn the Starch into Fuel and Protein to Animal Feed

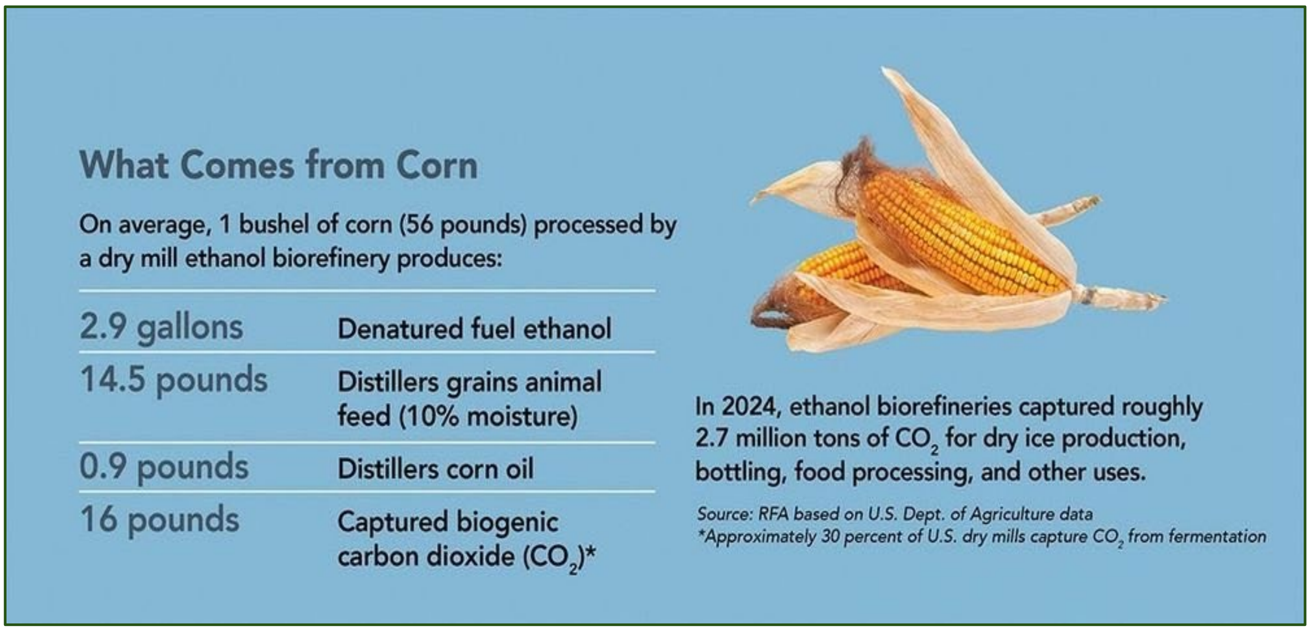
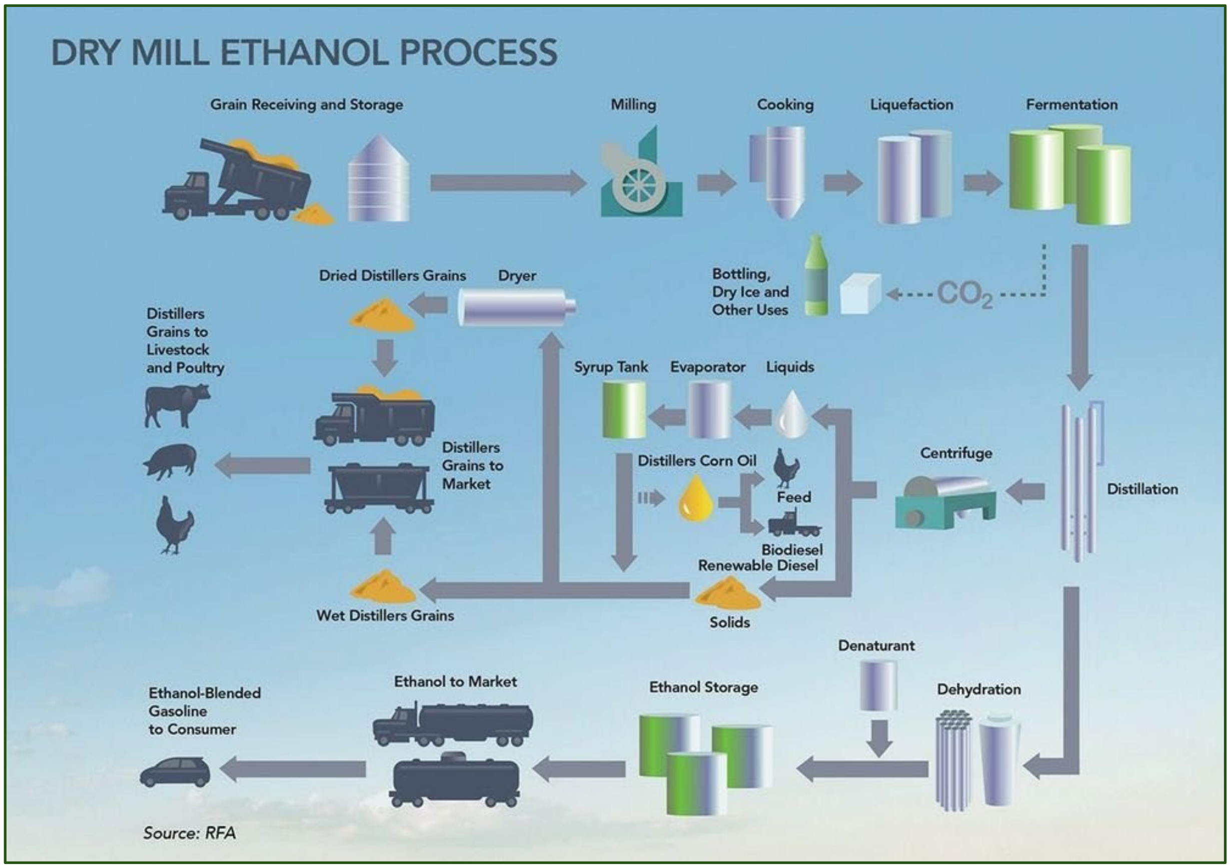


Figure 8:Ethanol's Fuel, Feed, Fiber, and Biobased Product Production Process



Vehicle Compatibility and Performance

The EPA has approved E15 fuel for all passenger cars, light-duty trucks, and SUVs manufactured in model years 2001 and newer, representing more than 96% of vehicles on the road today. - Consumer Reports

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Fuel and Vehicle Testing

Based on extensive historical experience and vehicle testing by the Department of Energy's National Renewable Energy Laboratory (NREL 2007)[383] and Oakridge National Laboratory (ORNL 2021),[384] it is highly likely that all light-duty vehicles (LDVs) globally are compatible with E10 (a blend of 10% ethanol and 90% gasoline). In addition to their own testing, the two studies referenced 166 other studies on vehicle fuel performance and compatibility. However, EPA did not approve E15 for use in light-duty conventional vehicles of model year 2001 and newer until 2011.[385] Vehicles manufactured in 2001 and later represent approximately 97% of the fuel sold in the U.S.

The history of E10 use in the United States, which began in 1978, shows no significant reliability or operability issues, even for vehicles manufactured before modern emissions controls were introduced. This real-world experience, combined with Brazil's successful introduction of E10 and even higher blends in the 1970s, strongly supports the conclusion that the chemical and property differences between E0 (gasoline with no ethanol) and E10 are minor enough to ensure compatibility with virtually any vehicle made to international standards over the last 50 years.

For higher ethanol blends, such as E15 (15% ethanol), vehicles with more advanced technology are more likely to be compatible. Specifically, vehicles meeting U.S. Tier 1 emissions standards (implemented in 1994) or their international equivalents are considered fully compatible with E15. These standards required more sophisticated air-fuel ratio controls and the use of more durable materials that are compatible with oxygenated fuels. Research into E20 (20% ethanol) compatibility is less extensive. Still, it indicates that vehicles meeting U.S. Tier 2 standards (phased in from 2004 to 2009) have the necessary materials and engine control authority to use E20 without significant issues. However, this conclusion is not as strongly supported by real-world experience as the conclusions for E10 and E15.

Two primary factors determine a vehicle's compatibility with ethanol blends: materials compatibility and operational compatibility. Materials compatibility refers to how well the fuel system's elastomers, plastics, and metals withstand exposure to ethanol without degradation, corrosion, or leaks. Operational compatibility involves the engine control system's ability to adjust the air-to-fuel ratio to compensate for the oxygen in ethanol, a process known as "enleanment". Modern vehicles equipped with three-way catalysts and oxygen sensors can typically compensate for the reduced oxygen content in E10 and E15 blends, ensuring regular engine operation and performance. However, some studies on E20 have noted potential concerns, such as accelerated catalyst degradation and minor engine wear over long-term use in certain vehicles.

Key insights:

Global E10 Compatibility is Very High: Based on decades of real-world use in the U.S. and Brazil, it is highly probable that all LDVs globally, including those manufactured before modern emissions controls, are fully compatible with E10 blends. Fuel system component manufacturers began integrating ethanol-compatible materials into their designs for the global market, making widespread E10 use feasible.

E15 Compatibility: In 2011, the EPA approved the use of E15 in light-duty conventional vehicles manufactured in and after the 2000 model year. Vehicles manufactured in 2001 and newer account for about 97% of the fuel sold in the U.S.

Emissions Standards Are a Key Indicator of Compatibility: A vehicle's emissions standard level is a good proxy for its technological sophistication and its ability to handle higher ethanol blends. Vehicles meeting U.S. Tier 1 standards (or equivalents like Euro 2) are likely compatible with E15, while those meeting Tier 2 standards (or equivalents like Euro 4) are likely compatible with E20.

Motorcycles Show Similar Compatibility Trends: An analysis of motorcycles in India and Indonesia indicates full compatibility with E10. Motorcycles meeting more recent emissions standards (such as Euro 4 or equivalent) that require closed-loop air-fuel ratio control should also be compatible with E15 blends.

Owner's Manuals Can Be Region-Specific and Conservative: Official guidance from auto manufacturers often varies by market. For instance, a Toyota Camry sold in the U.S. may be approved for E15. In contrast, the same model in Japan is only approved for E10, reflecting local fuel standards rather than the vehicle's inherent technical limitations.

Additional Context and Perspective

Brazil's Pro-Alcool Program

Brazil has one of the world's most advanced and long-standing ethanol vehicle programs, providing valuable insight into high-level blend compatibility. In response to the 1970s oil crisis, Brazil's Pro-Alcool program began mandating ethanol blends in gasoline for conventional vehicles, starting at 10% in 1977 and rapidly increasing to 20% by 1981. Initially, these higher blends were used in unmodified vehicles without major compatibility problems, partly because cars of that era had wide operational tolerances and lacked strict emissions controls. Over time, vehicles manufactured for the Brazilian market were specifically engineered and calibrated to run on high-ethanol gasoline. Today, standard gasoline in Brazil contains a 27% ethanol blend (E27), and flex-fuel vehicles (FFVs) that can run on any blend up to 100% hydrous ethanol are prevalent in the market.

Nebraska Ethanol Board Welcomes E30 Demonstration Interim Report

July 16, 2025: The Nebraska Ethanol Board (NEB) announced the publication of the interim report for Phase II of its project to demonstrate the viability of E30 fuel (a blend of 30% ethanol and 70% gasoline) in non-flex fuel vehicles. Phase I was conducted in 2019, and Phase II, which is ongoing, began in 2023. So far, the 94 State of Nebraska light-duty vehicles involved in Phase II have collectively driven more than 215,000 miles on E30 fuel. The research team from the University of Nebraska-Lincoln has found further evidence supporting the conclusions from Phase I: E30 is safe and effective for non-flex-fuel vehicles, and E30 is economically viable for broader consumption.[386]

Vehicle Availability

About 97% of vehicles can utilize E15. As of December 31, 2023, there were over 20.9M flex-fuel vehicles (FFVs) registered in the United States that can use any combination of fuel ethanol up to 85%. There were 309,300 FFVs registered in Maryland in 2023.

The peak number of flexible-fuel vehicle (FFV) models available in the U.S. was more than 80 in model year 2015. Nine different manufacturers offered these models. There are fewer than a dozen FFV models available from automakers in the 2025 model year, with GM and Ford offering a limited number of SUVs and pickup trucks (DOE AFDC).

- DOE Alternative Fuels Data Center listing of 2025 FFV models for sale and to identify FFVs manufactured in previous years.

Vehicle Emission Reductions

Federal and state agencies, as well as independent research institutions, have consistently documented the air quality and climate benefits of ethanol. From the EPA's early adoption of reformulated gasoline to recent findings from CARB, the Urban Air Initiative, and Argonne National Laboratory, evidence shows that higher ethanol blends reduce toxic pollutants, smog precursors, and greenhouse gas emissions. Together, these results underscore the crucial role of ethanol in improving urban air quality and advancing U.S. climate objectives.

- The U.S. EPA stated that reformulated gasoline (RFG), which includes oxygenates (ethanol), was mandated by the 1990 Clean Air Act to "burn more cleanly than conventional gasoline and reduce emissions of smog-forming and toxic pollutants". Oxygenates increase the "chemical oxygen" content of fuel, resulting in improved combustion and reduced emissions of carbon monoxide (CO), volatile organic compounds (VOCs), and toxic air pollutants, such as benzene and other aromatics.
- • A California Air Resources Board (CAreport from April 2025 states that increasing the amount of ethanol in gasoline from 10% to 15% (E10 to E15) results inhows significant reductions in particulate matter, carbon monoxide, total hydrocarbons, non-methane hydrocarbons, and carbon dioxide.
- Urban Air Initiative research has found that increasing ethanol blends (from E10 to E30) can reduce hydrocarbon aromatic use by up to 60%, thereby addressing toxic and carcinogenic components in urban air and lowering smog and ozone pollution. The initiative also promotes the benefits of ethanol in reducing particulate matter and ground-level ozone.
- Argonne National Laboratory (DOE, 2021): U.S. corn ethanol has 44–52% lower greenhouse gas (GHG) emissions than gasoline on a life-cycle basis, and these emissions have declined 20% since 2005 due to advances in corn yields and ethanol production.

Impact on Reducing Gasoline Prices

Ethanol blending has a proven track record of lowering retail gasoline prices by expanding supply and displacing higher-cost petroleum components. Studies consistently show that E15, a 15% ethanol blend, is more cost-effective than both E10 and conventional gasoline, offering consumers measurable savings nationwide. As evidenced by states like Minnesota and Iowa, the widespread adoption of E15 could translate into billions of dollars in annual fuel cost reductions nationwide, with significant benefits for Maryland drivers.

- February 27, 2023 - "Ethanol Cuts Gas Prices by **77** Cents per Gallon." - Impact of ethanol on gasoline prices in the U.S.: New evidence.
- E15 (15% ethanol blend) is consistently cheaper than E10 (10% ethanol blend) at the pump. Recent studies and industry reports show that E15 typically saves consumers between 10 and 30 cents per gallon compared to E10, with some locations reporting savings of up to $1 per gallon during specific periods. Nationwide, these savings add up. If the U.S. were to switch from E10 to E15 as the standard fuel, consumers could save over $20 billion annually in fuel costs.
- • State-level data support the finding that ethanol lowers fuel prices. For example, in Minnesota, E15 was on average $0.18 per gallon less expensive than E10 in 2024. Iowa drivers saved $38.5M in 2024 by choosing E15 over E10.
- EPA and AAA have acknowledged the cost advantages of E15, especially during periods of high gasoline prices and increased travel demand.

- **Perspective:** Maryland drivers could save $250 to $750M annually with E15.

Refueling Infrastructure

In the past decade, about $1 billion has been invested to encourage increased domestic energy production and reduce emissions from fossil fuels.[387] Financial assistance for wholesale terminals and fuel retailers has been provided in the form of grants from federal, state, and local governments, as well as financial support from biofuel and agricultural trade associations. Over 600 different fuel retailers have installed infrastructure to sell higher-ethanol blends.

After debuting at a Kansas gas station in 2012, E15 has spread rapidly and is now sold in over half the country.

- 4,744 retail stations sell E85.
    - **Maryland has 55 stations.**
- 1,835 stations sell a higher blend of ethanol, e.g., 15% or higher.
    - **Maryland has 41 stations.**
- 345 stations sell blends higher than 15% e.g., E20, E30, E35, E40 Plus
    - **Maryland has no stations.**

Table 49: Summary of Biofuels Infrastructure Funding for Terminals and Fuel Retailers

Level	State	Amount (USD)	Timeframe / Note	Program / Initiative	Description
Federal	Multi-state (29 states)	**$537M**	FY20-25; 543 projects	Higher Blends Infrastructure Incentive Program (HBIIP) – 2025 obligation	The USDA obligated funds for dispensers, tanks, and piping to expand the use of higher ethanol/biodiesel blends.
State	Iowa	**$61M**	Through FY25	Renewable Fuels Infrastructure Program (RFIP) – cumulative	State cost-share grants for E15/E85 and biodiesel infrastructure (dispensers, tanks, UST components).
State	Iowa	**$11M**	FY2025 (to date)	RFIP – FY2025 awards to date	FY2025 awards over $11M for 388 E15 projects and 39 biodiesel projects.
State	Minnesota	**$13+M**	FY2022–FY2025	AGRI Biofuels Infrastructure Grants – FY2022–FY2025 total	Grants for certified-compatible equipment at retail to expand access to E15+ blends.
Federal to State	Wisconsin	**$25+M**	Since 2021	HBIIP awards received in Wisconsin – cumulative since 2021	Cumulative HBIIP funding received by Wisconsin to enhance biofuel access.
Federal to State	Wisconsin	**$5M**	Project example (Jan 2025 press)	HBIIP project example – JT Petroleum (WI)	JT Petroleum to use a $5M grant to expand E15 and other renewable fuels infrastructure.
Federal to State	Michigan	**$4+M**	Announced Nov 2024	HBIIP project – Fleet Fueling of Michigan	USDA grant to install E15/E85 and B20 dispensers, along with ethanol and biodiesel storage tanks.
Federal to State	Illinois	**$~5M**	Announced Jan 11, 2024	HBIIP project – Casey's (multiple IL locations)	USDA grant to increase ethanol-based fuel availability at gas stations in IL.
Federal to State	Nebraska	**$~20M**	Announced Jan 22, 2024	USDA biofuel infrastructure grants impacting Nebraska	USDA awards biofuel infrastructure grants in Nebraska; more funds available.

Many newer dispensers from major manufacturers (Gilbarco, Wayne, etc.) are warranted or specified to support E15.[388] For example, Gilbarco dispensers have been generally compatible with E15 since ~2008. Some newer models claim higher ethanol-blend compatibility, even beyond E15 (e.g., newer Wayne dispensers are approved up to E40 in some instances).[389]

EPA has required UST systems to be compatible with the substances stored in them since the 1988 UST regulation. The EPA's 2015 UST regulation requires owners and operators of specific UST systems to ensure these systems are compatible with biofuels before storage.[390] For many USTs and fuel dispenser systems installed or manufactured in the past ~10-15 years, compatibility with E10 is almost universal. E10 has been the long-established baseline.

Underground Storage Tanks (USTs)

- **Inspection (federal minimums):**
  - **Monthly:** Release detection monitoring (leak detection).
  - **Annual:** Spill prevention equipment, overfill protection, and containment sumps.
  - **Every 3 years:** Secondary containment and corrosion protection testing.
  - **EPA Source:** 40 CFR Part 280 (UST Regulations).
- **Replacement (typical life cycle):**
  - Modern double-walled fiberglass or steel USTs are designed for 30+ years of service.
  - Many states or insurers encourage replacement at 25–30 years, since failure risks rise with age.
  - 1998 EPA deadlines mostly phased out pre-1988 tanks (single-walled steel).

Dispensers (Fuel Pumps)

- **Inspection:**
  - Annual state or local weights and measures inspections (to ensure fuel quantity accuracy).
  - Routine daily/weekly checks by operators for leaks, meter accuracy, credit card readers, and safety shutoffs.
- **Replacement (typical life cycle):**
  - Major pump manufacturers (Gilbarco, Wayne) suggest 10–15 years as a normal service life before replacement is cost-effective.
  - In practice, many dispensers are replaced sooner due to technology changes (chip-and-PIN, EMV card compliance in 2017), compatibility upgrades (E15/E85, biodiesel blends), or branding/marketing refreshes.

Table 50: Average Lifecycle Summary of Fuel Dispensers and Underground Storage Tanks

Equipment	Inspection Frequency	Replacement Cycle (Typical)
UST (tank system)	Monthly, Annual, 3-Year	25–30 years (modern systems)
Dispensers (pumps)	Annual + routine checks	10–15 years (often earlier for tech upgrades)

Underground Storage Tanks (USTs) last for decades (but require strict ongoing inspections), while dispensers are usually replaced about every 10–15 years, often accelerated by credit card security mandates or fuel compatibility needs.

National Perspective: PHEV-FFV Gets 293 Miles Per Gallon of Gasoline Used

General Motors debuted its Chevy Volt as a concept car in 2007 and started production in 2010. The Volt was discontinued in 2019 to focus on full-electric vehicles.

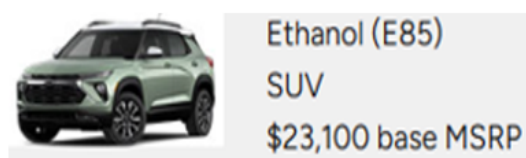
In less than an hour, the University of Nebraska's Husker Motorsports Team and RFA's Robert White installed a conversion kit from "eFlexFuel" on a new 2022 Ford Escape Plug-in Hybrid Electric Vehicle (PHEV) to make it run on any blend of ethanol E10 to E85. If a plug-in flexible fuel vehicle (FFV) traveled 15,000 miles in a year, with half the distance from electricity and half from E85, its effective miles per gallon of gasoline would be approximately 293 MPG.

There are over 20 million registered FFVs in the U.S. and 309,000 in Maryland. In 2015, nine automakers offered 80 different models of FFVs. Due to a loss of credits to make the vehicles, there are now only a dozen Flex-Fuel Vehicles. GM and Ford offer a limited number of SUVs and pickup trucks in 2025.

Figure 9: Back to the [Flex Fuel] Future

2010 GM Chevy Volt Plug-in

2022 Ford Escape PHEV Converted to FFV (E85)



2025 GM Trailblazer FFV Flex Fuel Vehicle FFV (E85)

Biodiesel: Product Overview

Biomass-Based Diesel

Biomass-based diesel is a fuel produced from renewable organic materials, including animal fats, vegetable oils, and waste cooking oils. This term is frequently used to describe biodiesel, which is produced through a chemical process called transesterification. In this process, fats or oils react with alcohol (usually methanol) in the presence of a catalyst to produce fatty acid methyl esters (FAME) and glycerin. Biodiesel can be used as a 100% diesel replacement (B100) or is most often blended with diesel at levels of 5% (B5) to 20% (B20).

Renewable Diesel

Renewable diesel is a high-quality fuel produced from feedstocks similar to those used for biodiesel (e.g., fats, oils, greases) but processed differently. This fuel is produced through hydrotreating, a refining technique that utilizes hydrogen to remove oxygen from the starting material, resulting in hydrocarbons that closely resemble those found in petroleum diesel. Renewable diesel is chemically indistinguishable from petroleum diesel and can be used as a drop-in replacement in diesel engines without blending.

In summary, while both fuels are derived from renewable sources and help reduce reliance on fossil fuels, renewable diesel is more closely aligned in quality and usability with petroleum diesel, making it more versatile for modern engines and infrastructure.

Key Properties

Renewable: Made from agricultural and waste fats/oils, biodegradable, and lower carbon than petroleum diesel.

Diesel Fuel Blending Levels: Common blends include B2 (2%), B5 (5%), B20 (20%), and B50 (50%) and B100 (100%).

OEM Acceptance: All major OEMs approve B5, and about 78–90% support B20 for medium- and heavy-duty trucks and equipment.

Lubricity: Even low biodiesel blends (B2–B5) can provide up to a 65% increase in lubricity, thereby reducing engine wear.

Cleaner Burn: Biodiesel blends produce fewer particulates, carbon monoxide, and hydrocarbons, thereby lowering emissions and improving combustion efficiency.

Cold Weather Performance: Lower blends (B5, B10) perform better in winter; cold flow improvers help higher blends.

Cetane Number: Biodiesel raises cetane, promoting more efficient combustion.

Table 51: Biodiesel Product Overview

Aspect	Biomass-Based Diesel (Biodiesel)	Renewable Diesel
Production Process	Transesterification (a chemical reaction involving alcohol and a catalyst).	Hydrotreating (refinery process using hydrogen).
Chemical Composition	Contains oxygen; produces FAME.	Pure hydrocarbons, no oxygen.
Compatibility	Needs blending with petroleum diesel to meet engine requirements (e.g., B20).	Drop-in fuel; fully compatible with all diesel engines and infrastructure.
Performance	Lower energy density compared to petroleum diesel; may have cold-weather performance issues.	Similar energy density and performance to petroleum diesel.
Emission Reduction	Reduces greenhouse gas emissions, but not as much as renewable diesel.	Typically achieves higher reductions in greenhouse gas emissions.
Storage and Stability	More prone to oxidation and degradation over time.	More stable, like petroleum diesel.
Cost	Generally, it is less expensive to produce.	Typically, it is more expensive due to the advanced refining process.

Federal Gasoline Standards Compliance

Biodiesel meets both the biomass-based diesel and advanced biofuel categories under the Renewable Fuel Standard (RFS). ASTM D975 approves up to B5 in regular diesel, while D7467 covers B6–B20 blends; fuels must be certified for compatibility and carbon intensity.

Biodiesel: Fuel, Feed, Fiber, and Biobased Product Production

Food, Feed, Fuel, and Fiber

Biodiesel is produced by chemically reacting vegetable oils or animal fats with alcohol (usually methanol), using a process known as transesterification to convert these fats and oils into biodiesel and valuable co-products.

Value-Added Products from Biodiesel Production

A key co-product of biodiesel production is glycerol (also known as glycerin), which accounts for approximately 10% of the output and is utilized in pharmaceuticals, cosmetics, and as a feedstock for bioethanol and other chemicals.

Oilseed meals (from soy and canola) left after oil extraction for biodiesel are also significant value-added products, widely used as protein-rich feeds for livestock. Other potential uses for co-products include energy generation, process heat, and the production of specialized industrial chemicals, which can enhance economic sustainability and reduce environmental impact.

Bio-based products, such as artificial turf, straws, and plastic bags, are made from renewable plant materials instead of petroleum, offering sustainable alternatives to traditional petrochemical products. These products help reduce reliance on fossil fuels and lower the carbon footprint of everyday items, from landscaping materials to single-use plastics. Innovations in materials—such as soybean oil-based turf, bioplastics from agricultural residues, and compostable packaging—demonstrate how renewable feedstocks can match or surpass conventional performance while supporting environmental goals.

Biodiesel: Vehicle Compatibility & Performance

Vehicle Compatibility

Biodiesel and conventional diesel vehicles are the same. Although light-, medium-, and heavy-duty diesel vehicles are not alternative fuel vehicles, almost all can run on biodiesel blends. The most common biodiesel blend is B20, which ranges from 6% to 20% biodiesel blended with petroleum diesel. However, B5 (a biodiesel blend of 5% biodiesel, 95% diesel) is also commonly used in fleet vehicles. B20 and lower-level blends can be used in many diesel vehicles without any engine modification.

All original equipment manufacturers (OEMs) approve the use of B5. However, it is essential to verify the OEM engine warranty to ensure that higher-level blends of this alternative fuel, such as B20, are approved for use. Visit Clean Fuels Alliance America for information on OEM support of biodiesel use in vehicles.

Vehicle Performance

Biodiesel raises the cetane number of the fuel and improves fuel lubricity. A higher cetane number means the engine is easier to start and reduces ignition delay. Diesel engines depend on the lubricity of the fuel to prevent moving parts from wearing prematurely. Improved lubricity reduces friction between moving parts, reducing wear. A primary advantage of biodiesel is that it can improve fuel lubricity at blend levels as low as 1%.

Biodiesel: Vehicle Emission Reductions

Biodiesel has emerged as one of the most effective low-carbon alternatives to petroleum diesel, delivering substantial reductions in greenhouse gas emissions and harmful air pollutants. Federal agencies, universities, and research labs have documented the benefits of these technologies across multiple applications—from buses and trucks to community health studies—showing consistent declines in particulate matter, carbon monoxide, and other toxic emissions. These findings reinforce biodiesel's role as both a climate solution and a public health benefit in urban and transit settings.

- The current DOE GREET model confirms that biodiesel, mainly when produced from waste oils, achieves significant emissions reductions (40–86%) compared to conventional diesel, supporting its use as a low-carbon transportation fuel under U.S. policy.
- Studies by the Mineta National Transit Research Consortium (MNTRC) found that using B20 biodiesel instead of ultra-low sulfur diesel (ULSD) significantly lowers particulate matter (PM) up to 17% on average, with newer buses achieving over 98% PM reduction compared to older models. B20 also lowers sulfur, elemental carbon (EC), and carbon monoxide (CO) compared to petroleum diesel.
- The U.S. EPA recognizes biodiesel as a verified retrofit technology for reducing diesel engine emissions, including PM.
- Studies by the DOE's National Renewable Laboratory found particulate emissions (PM_{10}) are 68% lower for buses running on biodiesel vs. petroleum diesel.
- Trinity Report: Assessment of Health Benefits from Using Biodiesel Fuel for On-Road Transportation Sources in the Bronx. This report assesses the health benefits of substituting biodiesel for diesel in on-road transportation sources in the Bronx, New York.

Biodiesel's Impact on Diesel and Home Heating Oil Prices

Biodiesel cuts emissions and also delivers meaningful cost savings for consumers and industries that rely on liquid fuels. Multiple studies and market reports indicate that biodiesel blends, such as B20, consistently sell at a discount compared to petroleum diesel, often by 30 to 50 cents per gallon. These price advantages translate into hundreds of millions in annual savings for states like Maryland, easing costs for truckers, farmers, and households alike.

- Fuels Institute study shows biodiesel on track to 10% volume share by 2022. A 2022 report estimated that from 2010 to 2021, the global introduction of biomass-based diesel reduced #2 diesel prices by 8% to nearly 19% annually, depending on the year and supply levels. U.S. production alone contributed to a 1–4% reduction in diesel prices.

- In New England, B20 retailed at an average price of $3.08 per gallon in January 2022, a whopping 49 cents lower than diesel prices. In the Central Atlantic region (New York, New Jersey, Pennsylvania, Delaware, and Maryland), B20 maintained a 34-cent price advantage to unblended diesel fuel, on average. - Klein, Steve. "A Final Word on Fuel Pricing." Oil & Energy Online.

Biodiesel Blends: Biodiesel (B20) Relative to Diesel

TABLE 10
Biodiesel (B20) and Diesel
Average Retail Prices by Region

Region	B20 Prices ($/gal)	Diesel Prices ($/gal)	Price Difference*
New England	$3.81	$5.11	-$1.30
Central Atlantic	$3.56	$4.92	-$1.36
Lower Atlantic	$4.29	$5.01	-$0.72
Midwest	$4.69	$4.81	-$0.12
Gulf Coast	$4.58	$4.74	-$0.16
Rocky Mountain	$5.04	$4.89	$0.15
West Coast	$5.44	$6.09	-$0.65
NATIONAL AVERAGE	$4.62	$5.06	-$0.44

Figure 10: Biodiesel's Impact on Lowering Fuel Prices

- Clean Cities Alternative Fuel Report: On average, during this reporting period, B20 cost $0.44 less per gallon than diesel.

Impact:

- **Lower Prices:** A 4% reduction in diesel fuel prices in Maryland is equivalent to $104.7M in annual savings. The savings can translate into lower costs for the trucking industry, farmers, and consumers.
- **Potential Lower Carbon Reductions Per Truck:** On average, a long-haul trucker covering between 120,000 and 150,000 miles per year will burn approximately 15,000 to 25,000 gallons of diesel annually. Studies show that B100 can achieve up to a 74% reduction in carbon emissions compared to diesel. At this rate, the same 25,000 gallons of B100 would reduce emissions by 414,825 lb. CO_2.

Biodiesel: Fuel Availability

The U.S. first began selling biodiesel fuel commercially in 1991, with initial production starting in Kansas City, Missouri. In 2025, the U.S. is projected to sell around 5.2 billion gallons of biodiesel and renewable diesel combined, representing a significant portion of domestic biomass-based diesel fuel use.

There are currently 1,369 stations in the U.S. that sell biodiesel (B20 and above).

- Maryland has 15 biodiesel stations. Four have public access.
- 1,719 EV station locations (5,357 EV charging ports)
- 2 Propane stations
- 9 CNG stations
- Zero hydrogen stations
- Zero LNG stations

The Maryland Energy Administration and the Metro Baltimore Clean Cities Coalition have been collaborating with partners to enhance energy security and improve air quality by developing alternative fuel infrastructure. Widely available in the Midwest, biodiesel fueling stations are growing in Maryland.

Table 52: Biodiesel Refueling Locations in Maryland

Company / Location	Company / Location	Access Requirements
Baltimore Biodiesel Cooperative	2800 Session St., Baltimore, Maryland 21211	Public
Cropper Oil & Gas	10535 Ocean Gateway, Berlin, Maryland 21811	Public
Cato Pacific Pride Fuel	2229 Northwood Drive, Salisbury, Maryland 21801	Public
Cato Pacific Pride Fuel	436 Eastern Shore Dr, Salisbury, MD 21804	Public
John F. Kennedy Highway Maintenance Yard I	2819 Belcamp Road, Belair, MD 21921	State Government
Fort McHenry Tunnel Facility	3990 Leland Avenue, Baltimore, MD 21224	State Government
John F. Kennedy Highway Maintenance Yard II	568 Bouchelle Road, Elkton, MD 21921	State Government
Francis Scott Key Bridge	304 Authority Drive, Baltimore, MD 21222	State Government
Baltimore Harbor Tunnel Facility	1200 Frankfurst Avenue, Baltimore, MD 21216	State Government
Harry W. Nice Bridge	9665 Orland Park Road, Newburg, MD 20664	State Government
Inter County Connector- Eastern Operations	13201 Virginia Manor Road, Laurel, MD 20707	State Government
Shell	2605 W. Liberty Rd., New Windsor, MD 21776	Public
Hillside Quick Serve	2630 Centerville Rd, Centerville, MD 21617	Public
Inter County Connector- Western Operations	16902 Crabbs Branch Way, Rockville, MD 20855	State Government
Bay Bridge	850 Revell Highway, Annapolis, MD 21409	State Government

National & Local Perspective: Biodiesel Performance and Compatibility

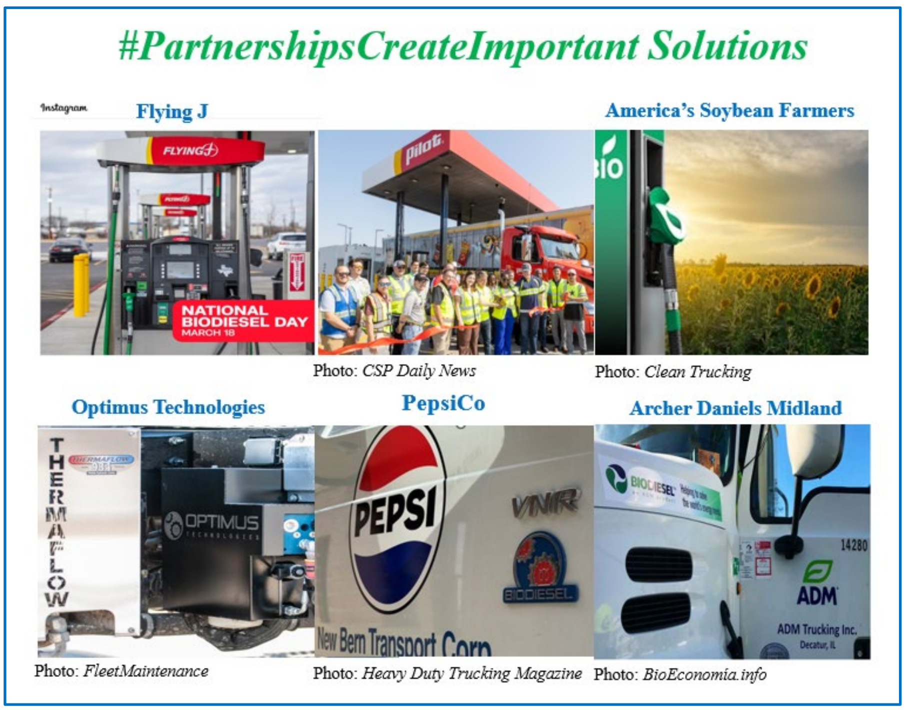
Prince George's County, Maryland: Backed by the Maryland Energy Administration and Chevron REG, Prince George's County retrofitted transit buses with Optimus Technologies' B100 Vector System, cutting emissions in underserved communities by over 75% per gallon—and up to 90% CO_2 for equipped vehicles. A similar project is underway in D.C.

Washington, D.C.: The D.C. Department of Public Works (DPW) has retrofitted and deployed refuse trucks with Optimus Technologies' Vector System, enabling them to run on 100% biodiesel (B100). The initiative began with a pilot program involving six garbage/recycling trucks in 2018.DPW reports that over 392 vehicles of its fleet use biodiesel, and that the city operates "one of the country's most significant 100% biodiesel programs." When using B100, the modified trucks are projected to reduce greenhouse gas emissions by up to 86% compared to conventional diesel vehicles.

Baltimore, MD: There are 15 biodiesel refueling locations in Baltimore. Maryland established a B20 Pilot Program and published "A Practical Guide to Using B20 in Your Fleet in 2007.

Nation's first B99 biodiesel fueling station for fleets at a Pilot Travel Center in Decatur, Illinois: ADM partnered with Optimus Technologies, Pilot Travel Centers, and PepsiCo to open the first B99 biodiesel fueling station for fleets at a Pilot Travel Center in Decatur, Illinois.

Figure 11: Nation's First B99 Biodiesel Refueling Location



"We know how important sustainability is to our customers and strive to help meet these growing needs for more sustainable fuel options for commercial fleets. Introducing B99 at our travel centers is another way we support fleets committed to reducing carbon emissions. This collaboration with PepsiCo, ADM, and Optimus Technologies exemplifies how partnerships can create impactful solutions."

-- Eric Fobes, head of renewables at Pilot.

Biodiesel Laws, Regulations, and Incentives in Maryland

Alternative Fuel Use Requirement

At least 50% of state vehicles using petroleum diesel fuel must use a minimum blend of 5% biodiesel (B5) or other biofuel approved by the U.S. Environmental Protection Agency as a fuel or fuel additive. This requirement does not apply to any state vehicles for which the use of biodiesel or other biofuel will void the manufacturer's warranty for that vehicle. Biodiesel fuel is defined as a fuel composed of mono-alkyl esters of long-chain fatty acids derived from vegetable oils or animal fats that is designated B100 or a blend of biodiesel that meets the requirements of ASTM Standard D6751. Additionally, bi-fuel and flexible-fuel vehicles capable of operating on either alternative fuel or conventional fuel must use the alternative fuel when it is available. (Reference: Maryland Statutes, State Finance and Procurement Code 14-408 and Policies and Procedures for Vehicle Fleet Management)

Clean Energy Grants

The Maryland Smart Energy Communities (MSEC) program, administered by the Maryland Energy Administration (MEA), offers local governments grants for transportation-related projects, including the purchase of new electric vehicles (EVs) or alternative fuel vehicles, as well as the installation of EV chargers. Grants are available in the following amounts:

Table 53: Maryland Smart Energy Communities (MSEC) Program

Project Type	Maximum Grant Award
Purchase of a New EV with an All-Electric Range of up to 199 Miles	$3,750 per vehicle
Purchase of a New EV with an All-Electric Range of Over 200 Miles	$7,500 per vehicle
EV Charging Equipment and Installation	$6,000 per EV charger

Communities may apply for funding for multiple projects, with a maximum grant award of $55,000 per project, or for a single project of up to $150,000. Additional requirements may apply. For more information, including requirements and the application deadline, please visit the MEA MSEC website.

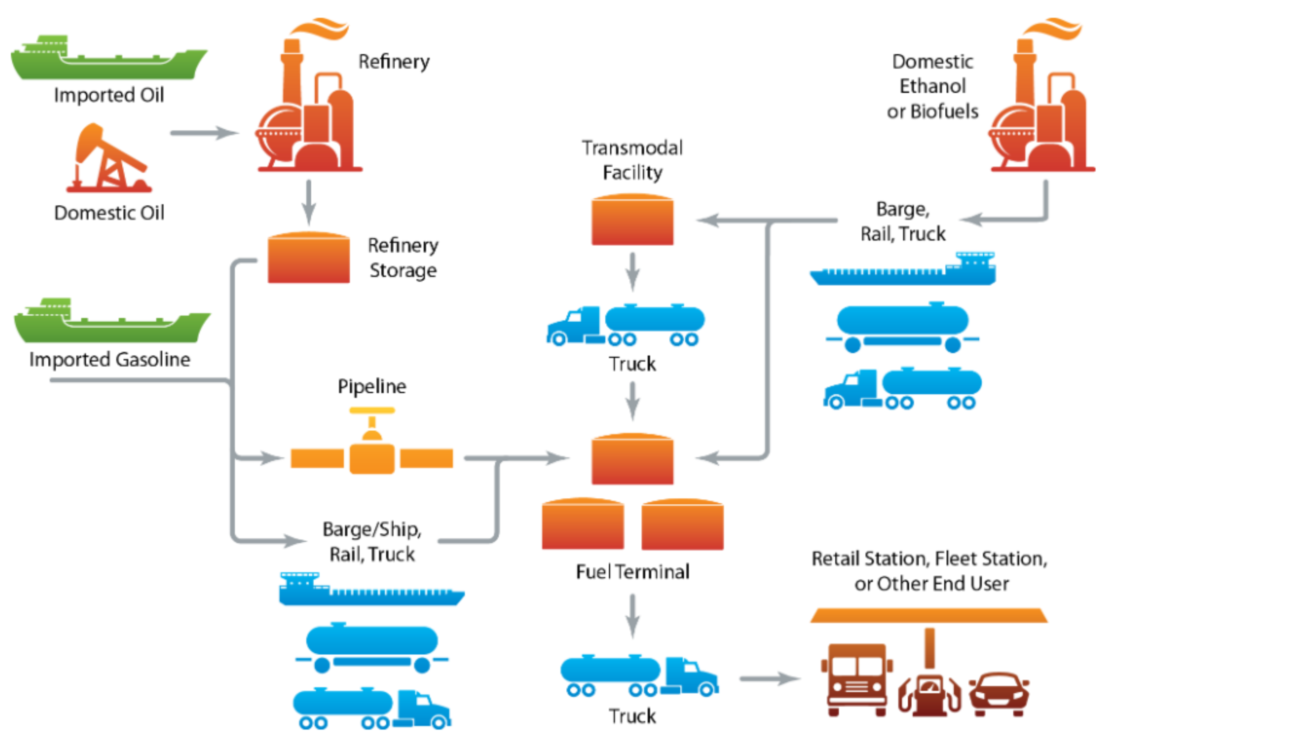
Section 9: Crude Oil, Gasoline, Diesel, and Biofuel Supply Chain Overview

The Federal RFS Created the Fuel Supply Chain Required to Increase Biofuels Blended with Gasoline and Diesel Fuel

Fuel Supply Chain Overview

The U.S. refining sector plays a central role in shaping gasoline supply, imports, and blending practices. While 132 refineries produce nearly all domestic gasoline, they rely on ethanol's high octane to meet federal fuel standards, shipping lower-octane gasoline blendstocks to terminals for final mixing. At the same time, market shifts and policy incentives are driving refinery conversions toward renewable diesel and jet fuel, marking a significant transformation in the United States' liquid fuels landscape.

Figure 12: Fuel Distribution Supply Chain



Schematic of the rail/truck ethanol distribution system. Grain is collected from farms and farm cooperatives and is trucked to an ethanol plant or biorefinery. From there, E95 goes by rail or truck to a terminal for fuel blending and storage. From the terminal, E10 or E85 is trucked to gasoline retail outlets.

Source: Dean Armstrong, National Renewable Energy Laboratory

Key Insights

There are 132 U.S. refineries. They produce 95% of the gasoline consumed in the U.S. In 2024, the U.S. imported 780 million barrels of crude oil from members of OPEC/OPEC+, accounting for ~25.4% of total imports, valued at around $60 billion. The U.S. exports approximately 13.65 billion gallons of finished gasoline annually.

- Ethanol is not blended at the refinery and is not shipped via pipeline. Refiners produce gasoline in anticipation of 113 octane ethanol being added at the wholesale terminal to meet the requirements of the federal Renewable Fuel Standard.

Refiners produce sub-octane gasoline blendstocks in anticipation that ethanol will be blended at the wholesale terminal and then loaded onto dealer tank wagon trucks for delivery to retail stations. Therefore, refiners are taking advantage of ethanol's high-octane to make a "Reformulated Blendstock for Oxygenate Blending" (RBOB). Reducing the need to produce higher octane at the refinery increases A U.S. Department of Energy/McKinsey & Company report found that as a result of ethanol's high octane, the amount of gasoline a refiner can produce from a barrel of oil increases by 3.2% for E10, 4.7% for E15, and 6.7% for E20, and avoids the economic hardship of investing in additional refining capacity to make BTEX. [391] The study was conducted in 2008, when ethanol production was only 9.3 billion gallons per year (BGPY).

- **Colonial Pipeline Product Codes & Specifications:** Their Quality Assurance Manual includes specs for CBOB (Conventional Gasoline Blendstock for Oxygenate Blending) and RBOB (Reformulated Blendstock for Oxygenate Blending), including octane, RVP, and related parameters.[392]
- **Sunoco Pipeline LP – Product Codes and Specifications:** The Sunoco/Energy Transfer specification document for CBOB and RBOB (Blendstock for oxygenate blending) gives octane ratings and other requirements for fungible gasoline shipped in pipelines.[393]
- **Buckeye — Fungible Product Grade Specifications:** The "Shipping Information Notebook" includes specifications for seasonal CBOB and RBOB grades with 10% denatured fuel ethanol blending, including octane levels.[394]
- **OPIS Methodology for Gasoline/RBOB/CBOB Specification:** OPIS (Oil Price Information Service) tracks wholesale gasoline products shipped via pipeline/barge to terminals and publishes spec definitions (as used in the spot markets) for CBOB, RBOB, etc.[395]

Table 54: Refinery Gasoline Specifications

Type	Specification
CBOB Reg	84 octane, pre-blend
Premium Gasoline	91–93 octane
RBOB Reg	84.6 octane, pre-blend

RBOB Pre	91.4 octane, pre-blend

Refineries Converted to Produce Renewable Diesel

Marathon Martinez Refinery (California): Transitioned to renewable diesel, propane, and naphtha production by 2023.

Phillips 66 Rodeo Refinery (California): Converted from processing crude oil to renewable diesel, now producing enough to meet about 40% of California's transportation diesel demand.

AltAir/World Energy Paramount Refinery (California): Converted to produce renewable jet **fuel and renewable diesel.**

Montana Renewables (Great Falls, MT): Expanded renewable diesel capacity in 2024.

REG-Geismer (Louisiana): Expanded renewable diesel capacity in 2024.

Additional Research Resources

Table 55: Key Studies on the Petroleum Supply Chain (Crude Oil to Consumer Gasoline)

Title / Agency	What It Covers / Why It's Useful
High Octane Fuel: Terminal Backgrounder *(Moriarty, NREL, 2016)*	Provides a clear overview of high-octane fuel distribution systems, focusing on terminal operations and their role in the fuel supply chain.
The Fuel and Petrochemical Supply Chains *(American Fuel & Petrochemical Manufacturers)*	Broad industry-level overview: how crude, NGLs, feedstocks move to refining / petrochemical plants, then to markets via pipelines, terminals, distribution networks.
Petroleum Refining: Industry's Outlook Depends on Market *(U.S. GAO)*	Focus on the domestic U.S. refining sector: Structural changes, regulatory pressures, profitability, constraints in feedstocks and markets.
Economic Impact Analysis for the Gasoline Distribution Industry *(EPA/RTI)*	Downstream focus: How finished gasoline is transported, stored, wholesaled, and retailed; cost structures and market impacts for distribution segments.
Increasing Globalization of Petroleum Products Markets *(U.S. GAO)*	Emphasis on midstream/downstream side: Refining, inventories, pipeline, and marine infrastructure; how global markets affect U.S. supply chains.
The Risk in Petroleum Supply Chain: A Review and Typology *(IJSER)*	More theoretical/academic: Identifies risks at different points in the supply chain (crude, refining, transport, etc.) and discusses modeling approaches for managing them.
EMD-80-55: How the Petroleum Refining Industry Responds to Federal Energy Policies *(GAO)*	Older but informative: Examines how refining changes in response to federal energy/conservation policies and describes the refining side in some detail.
New York State Transportation Infrastructure Study *(ICF International, 2012)*	Examines petroleum infrastructure in New York State, including crude oil transport, refining, terminal operations, and retail distribution.

Wholesale Fuel Terminals

There are 1,450 terminals in the United States, and 1,296 report storing on-road transportation fuels (OPIS 2015). As of 2023, over 1,200 terminals report that they store or have the capacity to store ethanol in all 50 states.[396]

Refiners ship fuels via pipelines, rail, tank trucks, and barge to the petroleum supply terminals.. Terminals are critical distribution hubs, strategically located near pipelines, highways, and coastal areas to efficiently supply fuel to retailers and end users.

Biofuels Refueling Infrastructure

Due to the RFS, nearly all of the approximately 1,450 wholesale fuel terminals in the United States have storage capacity and the infrastructure for fuel ethanol, and over 1,200 terminals also have biodiesel facilities.

Since 2005, it is estimated that at least 60% of fuel dispensers and storage tanks in the U.S. have been replaced or upgraded, e.g., compliance with new regulations, improved safety, greater efficiency, better fuel compatibility (such as for ethanol or biodiesel), enhanced customer experience, and reduced maintenance costs. Modern dispensers also offer advanced payment options, accurate metering, enhanced security, and digital marketing features, making them a compelling investment for station owners.

By the late 2000s, over 80% of underground storage tank systems were replaced due to new standards.

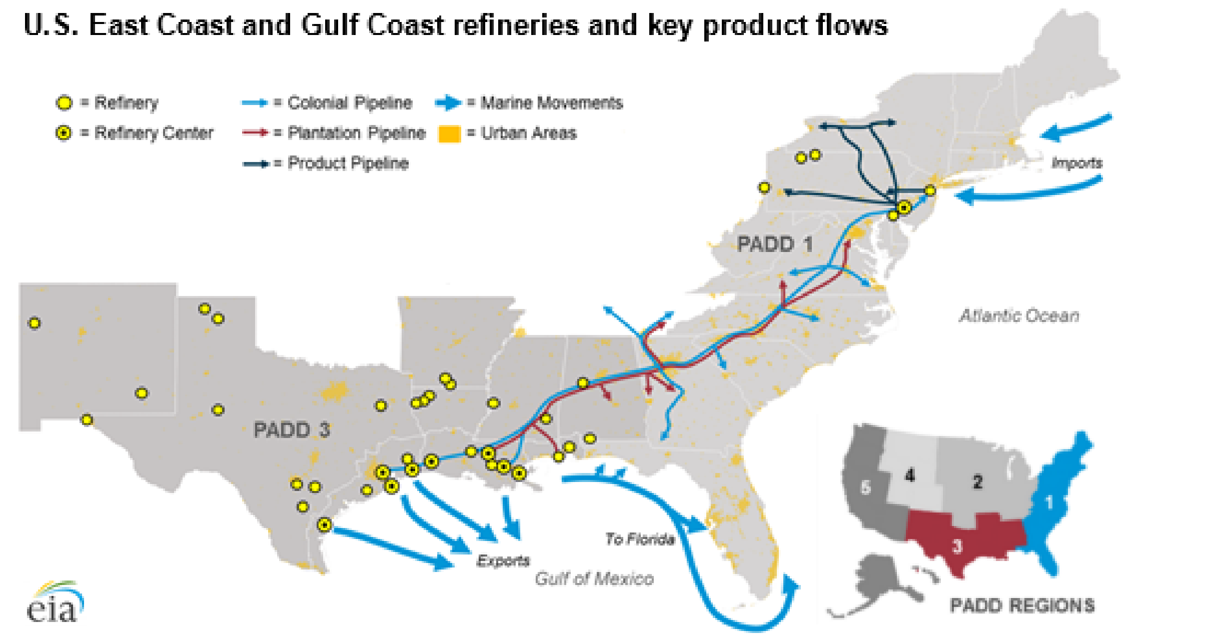
The Refinery, Wholesale Fuel Terminal, Retail Fuel Station Supply Chain

Pipelines, tankers, and barges convey transportation fuels from the Gulf Coast to the East Coast. The East Coast and Gulf Coast are highly dependent on each other to balance supply and consumption of transportation fuels (mainly gasoline, diesel, and jet fuel).

East Coast transportation fuel consumption is met through several supply sources, but none is more important than the Gulf Coast supply. Conversely, the surplus supply on the Gulf Coast is distributed to several domestic and foreign markets, but none is larger than that on the East Coast.

- ☑ **Impact:** Ethanol is not blended at wholesale fuel terminals and delivered by truck to retail gasoline stations. Ethanol is blended with sub-octane gasoline from the refinery to make 87 octane (E10), 88 Octane (E15), 89 Octane (midgrade), and 91-93 Octane (premium).

Figure 13: All Ethanol is Blended at the Wholesale Terminal



Source: U.S. Energy Information Administration, *PADDs 1 and 3 Transportation Fuels Markets*
Note: Click to enlarge. PADDs are Petroleum Administration for Defense Districts.

Wholesale/Retail Gasoline Prices

Wholesale gasoline prices reflect the cost of crude oil and refining, while retail prices include federal and state taxes, as well as station operating costs and profit margins.

Table 56: East Coast Wholesale Gasoline Prices (Terminal/Rack Level)

Gasoline Grade	Retail Price (Aug 25, 2025)	Wholesale Estimate*
Regular Unleaded 87	$3.272/gal	~$2.63–$2.88/gal
Mid-Grade 89	$3.543/gal	~$2.86–$3.10/gal
Premium 93	$4.002/gal	~$3.22–$3.45/gal

Source: OPIS

Federal and State Fuel Taxes

The federal excise tax on gasoline in the United States is 18.4 cents per gallon ($0.184/gal) as of 2025. This rate was last increased in October 1993, when it was raised from 14.1 cents to 18.4 cents per gallon under the Omnibus Budget Reconciliation Act of 1993 (32 years).

For August 2025, the total gasoline taxes (federal, state, and local) for Maryland, Virginia, Washington, D.C., and Delaware are as follows:

Fuel Taxes

The United States ranks very low among the top 50 countries with the highest fuel taxes—typically 40th or lower—due to its much lower combined federal and average state gasoline and diesel tax rates compared to nearly all of Europe and much of the developed world (DOE AFDC).

U.S. Fuel Tax Ranking Globally (2025)

- U.S. combined average gasoline tax: around \$0.57–\$0.74 per gallon (including federal and average state).
- U.S. combined average diesel tax: around \$0.61–\$0.88 per gallon.
- Top 10 countries (e.g., Netherlands, UK, Italy) have fuel taxes ranging from \$2.46 to \$3.77 per gallon or even higher for both fuels.
- The U.S. usually ranks between 40th and 50th globally for gasoline/diesel tax burden among developed nations and oil importers, with dozens of countries having much higher per-gallon fuel taxation.

Table 57: Federal and State Gasoline Taxes in MD, VA, and DC

Rank	State	Gasoline Tax (¢/gal)	Diesel Tax (¢/gal)	Combined (¢/gal)
1	Pennsylvania	57.600	74.100	131.700
2	California	61.200	44.100	105.300
3	Washington	55.400	49.400	104.800
4	Illinois	48.300	52.900	101.200
5	Indiana	36.000	57.000	93.000
6	Ohio	38.500	47.000	85.500
7	North Carolina	40.300	40.400	80.700
8	Oregon	38.000	40.000	78.000
9	Maryland	46.000	31.800	77.800
10	Rhode Island	40.000	37.000	77.000
11	Utah	38.500	36.500	75.000
12	Georgia	33.100	36.200	69.300
13	Idaho	32.000	32.000	64.000
14	Montana	33.000	29.800	62.800
15	Virginia	31.700	30.800	62.500
16	Michigan	31.000	30.000	61.000
17	Nebraska	31.800	29.100	60.900
18	Alabama	30.000	30.000	60.000
19	New Jersey	44.900	13.500	58.400
20	Kentucky	25.000	25.700	50.700
21	Washington D.C.	23.500	23.500	47.000
	Country			
40-50	U.S. Federal Tax	18.400	22.400	40.800
1	Netherlands	3.770	3.150	6.920
2	United Kingdom	3.570	3.000	6.570
3	Italy	3.460	3.100	6.560
4	France	3.250	2.780	6.030
5	Finland	3.200	2.920	6.120
6	Denmark	3.160	2.790	5.950

Retail Fuel Prices

Gasoline price apps—often referred to as fuel price locator apps or alternative fuel station finders—help drivers compare real-time fuel costs, locate nearby stations, and, in some cases, earn rewards or cash back on purchases. Popular consumer platforms include GasBuddy, Upside, Gas Guru, Waze, and AAA Mobile. Meanwhile, specialized tools such as the U.S. DOE's Alternative Fuels Data Center (AFDC) Station Locator, Find E85, Find D15, and Ethanol Free apps cater to drivers seeking higher ethanol blends, biodiesel, or non-oxygenated gasoline.[397] Together, these resources provide transparency, convenience, and greater consumer choice in both conventional and alternative fuel markets.

Table 58: Most Popular Gas Price Finding Apps

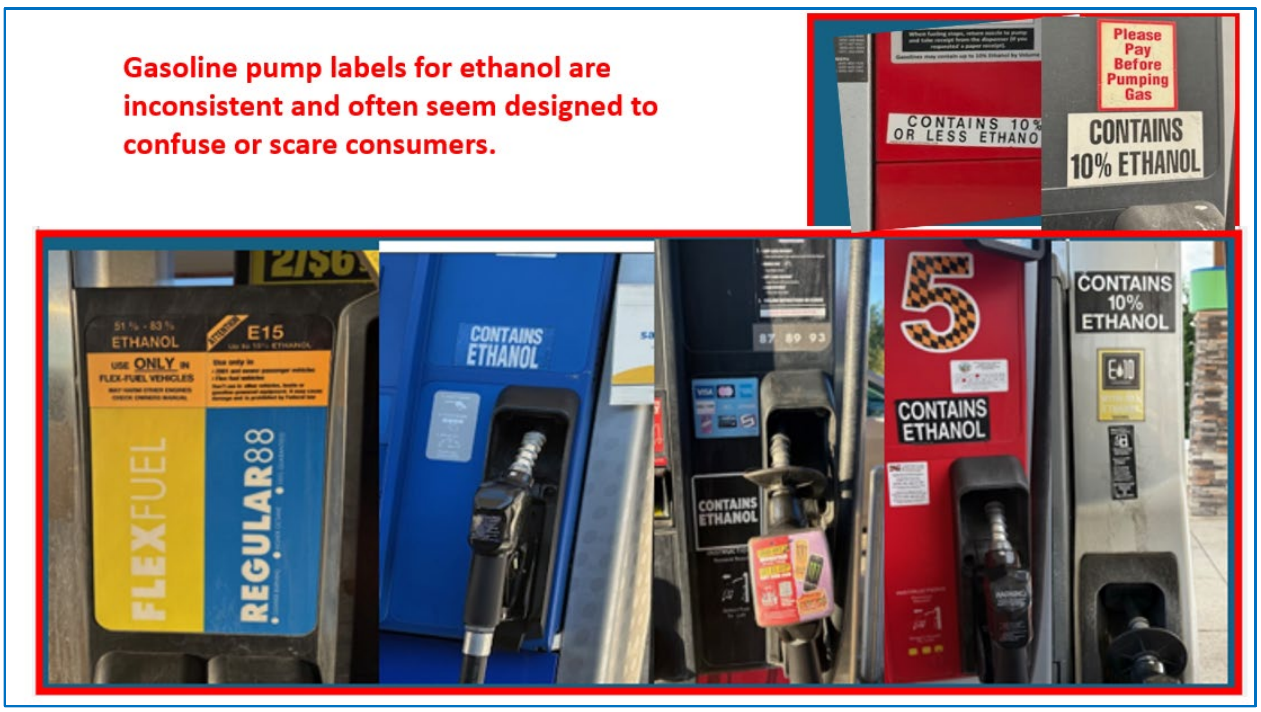
App	Source(s) / Links	Key Features / Why It's Popular
Apps that focus on alternative fuels		
DOE AFDC Alternative Fuels Station Locator	DOE AFDC	Official U.S. Department of Energy tool; the most comprehensive nationwide database for E85, biodiesel, renewable diesel, CNG, propane, hydrogen, and EV charging.
Find E85	Google Play	Dedicated app for finding E85 (85% ethanol) fueling stations; often shows pricing and station amenities.
Find E15	Growth Energy / Get Biofuel	[illegible]
Biodiesel Now	Clean Fuels Alliance of America	A biodiesel-specific locator app created by the National Biodiesel Board shows B20+ stations and distributors.
Ethanol Free	Google Play	Identifies stations selling ethanol-free gasoline (often sought by boaters, small-engine users, or classic car owners).
GasBuddy	Google Play; NerdWallet	Likely the most well-known. It utilizes crowd-sourced data to display real-time gas prices, allows users to filter by fuel grade or station amenities, and offers savings through promotions.
Upside (formerly GetUpside)	wkfcu.org	It allows users to find discounts or cash-back offers at gas stations, upload receipts, and earn money back. Suitable for occasional bonus savings.
Gas Guru	Google Play	A simple, no-frills option using data sources like OPIS. It is helpful for quickly comparing prices without too many extras.
Waze	Tom's Guide	A navigation app that also shows nearby gas stations and gas prices. Helpful for finding cheaper fuel along your route.
Checkout 51	wkfcu.org	Offers cash back and fuel deals, among other retail promotions. You claim offers, upload receipts, and redeem rewards.
AAA Mobile	NerdWallet	An AAA member fuel price lookup and trip planning tool. Often used by people who already have a suite of travel/road services.

Biofuel’s Supply Chain Challenges and Opportunities to Overcome Them

Challenge: Fuel Dispenser Labeling

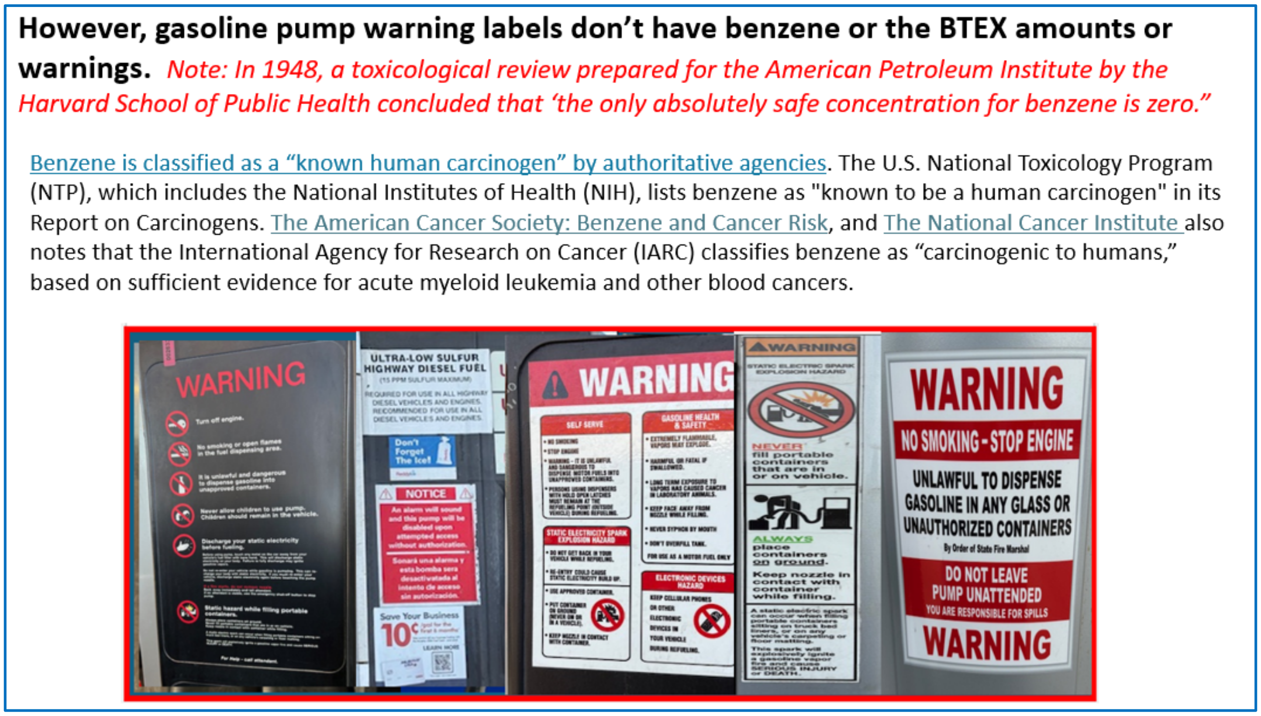
Gasoline pump labeling in the United States is inconsistent, confusing, and often ineffective at informing consumers. Unlike most products containing carcinogens—such as cigarettes, alcohol, food, and pharmaceuticals—which must carry health or environmental warnings, gasoline stations generally do not have to display such warnings about the harmful substances in gasoline, except in California. Instead, the limited labels that exist tend to focus narrowly on ethanol content, often phrased negatively or confusingly, such as “may contain up to 10% ethanol.” Most drivers either overlook these labels or don't understand them, according to surveys and interviews.

Figure 14: Gasoline Dispenser Labels: Inconsistent with Bad Intent



Historical factors have further complicated the issue. In the 1980s, biofuel detractors spread concerns that ethanol could damage engines, leading to widespread skepticism. These warnings linger in public perception, despite four decades of safe use in hundreds of millions of vehicles. Much like how tobacco was once glamorized before warning labels revealed its dangers, modern gasoline dispensers often tout the advantages of high octane while still keeping consumers unaware of the health risks posed by the toxic substances, such as benzene, toluene, ethylbenzene, and xylene (BTEX), that provide the octane.

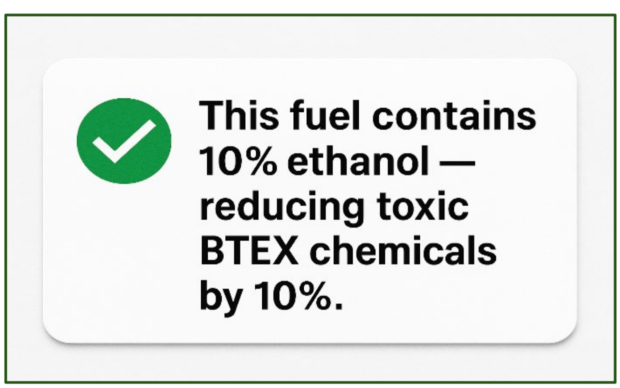
Figure 15: Ethanol Content and/or Benzene Content Labeling



Biofuel Opportunity: New Fuel Dispenser Labeling

A more balanced and science-based approach to labeling could shift public awareness. If consumers are told only that their fuel "contains ethanol," the message implies caution. But if the label instead explained that ethanol displaces toxic aromatics—e.g., "This product contains 10% ethanol and therefore has 10% less BTEX"—drivers would understand the health and environmental benefits. Alternatively, a more direct message—"This product contains up to 20% BTEX, known carcinogens"—would mirror the labeling standards applied to food, alcohol, and tobacco. Either approach, whether highlighting ethanol's positives or calling attention to gasoline's negatives, would be a step toward honest disclosure and a much-needed foundation for public education on cleaner fuels.

Figure 16: A Lower Carcinogenic Fuel Standard?



Biofuel Challenge: Consumer Awareness, Public Education, and Pricing

Frequent Driver Fuel Discount Programs

Fuel rewards programs have become a common way for retailers to attract and retain customers, offering discounts ranging from a few cents per gallon to as much as $2 per gallon through loyalty cards, credit programs, and grocery partnerships. These programs demonstrate that consumers are already accustomed to price differentiation at the pump and will adjust their behavior to capture savings. This same model can be leveraged to market higher-quality, greener fuels—such as ethanol blends or biodiesel—at competitive or even lower net prices. While not every driver will respond, there is a clear overlap with consumers who already pay more for organic food, bottled spring water, or premium high-octane fuel, making them an early adopter market for cleaner, high-performance fuels offered at a discount through similar rewards

Figure 17: Figure 17: Fuel Rewards Programs in Washington D.C., Maryland, and Delaware

structures.

Lower prices can also capture market share for retailers and drive in-store purchases and frequent driver programs.

Case Study: Burl Haigwood, Maryland Biofuels Task Force Coordinator August 29, 2025

Sheetz was selling 88-octane E15 for 30 cents less than 87-octane E10. In this particular case, I decided to mix 5 gallons of E85100 octane, priced at $2.49 per gallon, with 15 gallons of E10 87 octane.

- I created a blend of 28.7% ethanol with an octane rating of 91.5, which would meet the minimum specification for a vehicle that is classified as "premium required" – about 50% of the cars sold today.

- The self-blending provided a savings of $1.10 per gallon when compared to having to buy the 93-octane fuel, because the 89-octane blend would not meet the "premium required" level of at least 91-octane.
- If the vehicle were a 2025 GM Flex Fuel Vehicle, the 28.7% blend would reduce mileage by about 3-8%; it was about 10% for me.

Step 1. Baseline (E0/E10 gasoline at $3.64/gal)

- Tank size = 20 gallons
- Cost = 20 × $3.64 = $72.80
- Mileage = 22 mpg × 20 gal = 440 miles per tank

Step 2. With E28.7 (at $2.74/gal)

- Tank cost = 20 × $2.74 = $54.80
- Energy penalty = ~9.6% mpg drop vs E0 (≈6–7% vs E10). Let's use 9.6% as a conservative estimate.
- Adjusted mpg = 22 × (1 − 0.096) = 19.9 mpg
- Range = 20 gal × 19.9 mpg = 398 miles per tank

Step 3. Effective cost per mile

- Gasoline baseline: $72.80 ÷ 440 miles = $0.1655/mile
- E28.7: $54.80 ÷ 398 miles = $0.1377/mile

Step 4. Net savings

- Savings per fill-up = $72.80 − $54.80 = $18.00
- Adjusted for mileage loss (cost per mile): $0.1655 − $0.1377 = $0.0278/mile saved
- Over 398 miles, net savings = 398 × $0.0278 ≈ $11.05

Step 5: Using DOE Argonne GREET's range for corn ethanol (≈**44–52%** lower CI than gasoline):

- Treat gasoline CI = 100; ethanol CI = **56–48**.
- With **E28.7** (28.7% ethanol, 71.3% gasoline) in a 20-gal fill, the weighted result cuts tank-level CO_2e by about **12.6%–14.9%** vs. straight gasoline (E0).

☑ **Carbon Reduction** ~13–15% carbon reduction **for E28.7 under that GREET range.**

☑

Table 59: Sheetz Higher Biofuel Self-Blending Economic Use Case

Scenario	Fuel Cost/gal ($)	Gallons	Fill-up Cost ($)	MPG	Range (miles)	Pump Savings ($)	Net Savings ($)	Fee Costco Chickens Equivalent
Baseline Gasoline	3.64	20	72.8	22	440	0	0	
E28.7 (9.6% mpg loss)	2.74	20	54.8	19.9	398	18	11.05	2.2
E28.7 (5% mpg loss, optimized)	2.74	20	54.8	20.9	418	18	14.38	2.9

Context and Perspective

☑ **Context:** Gasoline contains toxic aromatic compounds (BTEX), and the safe threshold for benzene exposure is zero. Ethanol blends displace these aromatics while also lowering carbon emissions.

☑ **The Buyer's Personal Perspective:** Editor's Viewpoint: Gasoline's toxic aromatics have no safe threshold. By using higher-ethanol blends—which reduce BTEX emissions by nearly 30% and cut carbon by 14%—we achieve cleaner fuel, cleaner air, and lower costs. That is a truly priceless benefit.

Figure 18: Use Case: Economics of E15 and Customized E85 Blending

Biofuel Challenge and Opportunity: Increasing the Supply and Storage of Biofuels

Opportunity: Strategic Biofuel Reserve

The U.S. biofuel capacity of 21 billion gallons per year is 3 times the size of the U.S. Strategic Petroleum Reserve.

- Emergency releases from the SPR have historically occurred during crises to stabilize energy markets and reduce fuel prices, often having a measurable effect on gasoline costs.
- SPR releases have generally led to lower fuel prices, with Treasury analyses showing price decreases of up to 31 cents per gallon following the 2022 releases.
- Each emergency drawdown has helped maintain supply reliability during wars, market shocks, or natural disasters.
- 404M barrels (MMBBL) of crude oil, which is stored in underground caverns in Texas and Louisiana, is valued at $20+ billion.
- Assuming a 42% average gasoline yield per barrel, the entire SPR would produce 7.1 BGAL of gasoline for about 3 months.

Table 60: Strategic Petroleum Reserve Crude Oil Supply

Crude Released (barrels)	Gasoline Yield (barrels)	Gasoline Yield (gallons)	Initial Market Delivery	Maximum Daily Drawdown	Full Release Duration
404,000,000	169,680,000	7.1B	~2 to 4 weeks	4,400,000	~92 days

Why Now and How Snapshot

Maryland already moves and stores large volumes of gasoline and diesel through a dense network of bulk terminals (tank farms), port and rail assets, and state-owned fueling depots. Standing up a strategic biofuel reserve (ethanol for gasoline blends and biodiesel/renewable diesel for distillate) can leverage this footprint, prioritizing sites near the Port of Baltimore, rail spurs, and existing state fueling hubs for rapid deployment during supply shocks or extreme weather events.

Maryland's existing fuel-handling footprint (order-of-magnitude)

- **Gas stations (retail endpoints):** On the order of **~1,300–1,600** sites statewide (most are convenience stores that sell fuel; c-stores sell ~80% of U.S. gasoline). Use County Business Patterns NAICS 447 for a defendable Maryland count and NACS for the share sold via c-stores.[398]

- **Airports: 34 public-use airports** (and **~129 total licensed landing facilities** in CY2024). These are prime candidates for on-site biodiesel/renewable diesel storage (ground service equipment) and SAF blending pilots.
- **Wholesale gasoline/distillate terminals (tank farms): Multiple bulk terminals clustered around the Port of Baltimore** (Curtis Bay/Fairfield/Hawkins Point/Canton) plus **Salisbury**—examples include Sunoco's four listed Maryland terminals and other operators shown on EIA's petroleum terminal atlas and the Port's terminal map. Practically, this is your core "storage farm" backbone for reserve barrels.
- **Military installations (federal): ~10 major federal installations** with on-base fueling/storage (e.g., Aberdeen Proving Ground, Fort Meade, Joint Base Andrews, NAS Patuxent River, NSWC Indian Head, Fort Detrick, USCG Yard). These are strategic anchor sites for resilience fuel stocks and priority fleets.
- **State fueling sites (DGS network): 100+ state-owned fueling locations** (highway depots, law enforcement, MDTA, DGS capital facility, etc.) in the **Statewide Automated Fuel Dispensing & Management** system—ideal for distributed reserve placement and rotation.

Ports and Rail

- The **Port of Baltimore** hosts multiple petroleum terminals and adjacent rail yards (e.g., Canton RR; Norfolk Southern Bayview Intermodal), providing marine and rail access for inbound biofuels and outbound truck distribution. Co-locating reserve volumes here minimizes build-out.

A Practice Path to Implementation

1. Utilize existing tank farms first: Secure dedicated ethanol/biodiesel/renewable-diesel capacity at Baltimore-area terminals and Salisbury, integrating with terminal blending racks.
2. **Pre-position at state depots:** Allocate rotating reserve volumes at select DGS/SHA sites statewide (north/south/eastern shore pan). Tie into the FY25 Resilient Maryland Program and Fuel Up Maryland resiliency grants for eligible retail partners and volunteer firehouses.

   "Tie into Fuel Up Maryland" resiliency grants. This was an earlier name for a program that provided funding to help service stations and firehouses install backup power to maintain critical operations during energy emergencies. It is now part of the broader Resilient Maryland Program, administered by the Maryland Energy Administration (MEA). Initially, the program had specific eligibility requirements and funding caps:

- **Funding:** Offered up to $25,000 for service stations and up to $50,000 for volunteer firehouses to cover up to 70% of project costs.

- **Purpose:** To help facilities purchase or pre-wire for backup generators or batteries, ensuring fuel could be dispensed during a power outage.
- **Eligibility:**
  - **Service stations:** Required to have at least 10,000 gallons of fuel storage and annual sales of 75,000 gallons or more. Installations are needed to power at least the station's fuel pumps.
  - **Volunteer firehouses:** Did not need fuel pumps but had to act or be able to act as an emergency shelter.
- How the program has evolved.
  - The former Fuel Up program has been incorporated into the MEA's broader Resilient Maryland Program, which offers funding for a wider range of projects. The current program provides incentives for microgrids, resilient facility power systems, and resiliency hubs. It has multiple funding categories, including:
  - **Preconstruction planning grants:** To help with feasibility analyses and modeling.
  - **Capital support funding:** To assist with equipment and installation costs.
  - **Resiliency hub grants:** To fund solar energy and battery storage systems for central community locations.

3. **Defense & airports as resilience nodes:** Pilot reserves at Andrews, Meade, APG, Pax River, and at several public-use airports (for GSE and emergency generation).

Table 61: Potential Strategic Biofuel Storage Nodes (Military)

City	Type	Access	Facility Name	Fuel Types
Aberdeen/Edgewood	U.S. Army	Rail/Truck (area)	Aberdeen Proving Ground (APG)	On base fleet fueling (various)
Fort Meade	U.S. Army	Rail/Truck (area)	Fort George G. Meade	On base fleet fueling (various)
Camp Springs	U.S. Air Force	Pipeline/Truck (area)	Joint Base Andrews (JBA)	On base fleet fueling (various)
Patuxent River	U.S. Navy	Truck (area)	NAS Patuxent River	On base fleet fueling (various)
Frederick	U.S. Army	Truck (area)	Fort Detrick	On base fleet fueling (various)
Indian Head	U.S. Navy	Rail/Truck (area)	NSWC Indian Head	On base fleet fueling (various)

Table 62: Potential Strategic Biofuel Storage Nodes (Public/Private)

City	Type	Access	Facility Name	Fuel Types
Baltimore	Wholesale Terminal (Gasoline/Distillate)	Port, Pipeline, Truck	Sunoco Fuel Supply Terminal - Pennington Ave	Gasoline, Diesel
Baltimore	Wholesale Terminal (Gasoline/Distillate)	Port, Pipeline, Truck	Sunoco Fuel Supply Terminal - Northbridge Ave	Gasoline, Diesel
Baltimore	Wholesale Terminal (Gasoline/Distillate)	Port, Pipeline, Truck	Sunoco Fuel Supply Terminal - Frankfurst Ave	Gasoline, Diesel
Salisbury	Wholesale Terminal (Gasoline/Distillate)	Truck, Rail (area)	Sunoco Fuel Supply Terminal - Salisbury	Gasoline, Diesel
Baltimore	Wholesale Terminal (Gasoline/ULSD)	Pipeline (Colonial), Barge/Ship, Truck	Kinder Morgan Curtis Bay Terminal	RBOB, PBOB, ULSD
Baltimore	Bulk Liquid Terminal	Port, Rail (vicinity)	Liquid Transfer Terminal, Inc. (Hawkins Point)	Liquids (potential petroleum/biofuels)
Glen Burnie	State Fuel Site (Gasoline)	Truck	MSP Barrack P - Glen Burnie	Gasoline
Annapolis	State Fuel Site (Gasoline/Diesel)	Truck	SHA Annapolis Maintenance	Gasoline, Diesel
Annapolis	State Fuel Site	Truck	Maryland Dept. of Agriculture (MDA) Fuel Site	Biodiesel (per listing), Gasoline
Baltimore/Anne Arundel County	Airport (Public use; State Owned)	Pipeline/Truck (area)	BWI Thurgood Marshall Airport (BWI)	Jet/Avgas/GSE fueling (diesel/gas)
Middle River	Airport (Public use; State Owned)	Truck (area)	Martin State Airport (MTN)	Jet/Avgas/GSE fueling (diesel/gas)

Section 10: Leveraging Federal Government Research and Policies

Federal Legislative and Regulatory Challenges Provide Opportunities to Set a Precedent to Improve State Fuel Standards

Science is Changing the Biofuels Narrative

Federal policy shifts—most notably the Inflation Reduction Act's Section 45Z Clean Fuel Production Credit and USDA's climate-smart agriculture (CSA) provisions—have created a national framework that rewards measurable carbon reductions and strengthens the credibility of biofuels as clean, reliable alternatives. These policies exclude speculative land-use penalties, standardize lifecycle analysis around GREET modeling, and incentivize on-farm practices that reduce carbon intensity at the feedstock level. For Maryland, these developments provide both technical justification and political cover to adopt stronger clean-fuel policies, including a potential Low Carbon Fuel Standard, while simultaneously countering outdated "food vs. fuel" narratives.

Key Insights

- **Federal Precedent:** The 45Z Clean Fuel Production Credit establishes a unified emissions-based incentive, rewarding biofuels with lower lifecycle GHG emissions and extending planning certainty through 2029.
- **USDA Climate-Smart Agriculture:** New guidelines verify farm-level carbon reduction practices (cover cropping, reduced tillage, nutrient management), lowering feedstock CI scores and boosting biofuel eligibility for higher credit values.
- **Exclusion of ILUC Penalties:** Recent federal reforms removed speculative indirect land-use change penalties from 45Z scoring, giving U.S. biofuels a fairer assessment and improving competitiveness.
- **Modeling Alignment:** GREET is now recognized as the federal benchmark for lifecycle analysis, providing Maryland with the rationale to supplement EPA's MOVES model for more accurate emissions accounting.
- **State Opportunity:** These federal frameworks empower Maryland to design a Low Carbon Fuel Standard that captures ethanol and biodiesel's benefits, aligns with national policy, and strengthens agricultural and economic resilience.

45Z Clean Fuel Production Credit

- ☑ **Federal precedent:** The 45Z Clean Fuel Production Credit (IRA, extended by OBBBA) and USDA climate-smart agriculture standards reward measurable lifecycle GHG reductions and exclude speculative ILUC penalties.
- ☑ **Public education shift:** These changes help counter outdated "food vs. fuel" claims and show that U.S. biofuels reduce carbon while supporting agriculture.
- ☑ **Modeling alignment:** GREET is now the federal benchmark for lifecycle analysis; Maryland can strengthen its policies by supplementing EPA's MOVES with GREET.
- ☑ **State justification:** Together, these federal policies provide Maryland with both the technical framework and the political justification to implement a Low Carbon Fuel Standard that fully captures the environmental and economic benefits of ethanol and biodiesel.

Clean Fuel Producer Credit 45Z

The 45Z Clean Fuel Production Credit was established under the Inflation Reduction Act (IRA) of 2022 to incentivize domestic production of low-carbon transportation fuels, replacing various "legacy" biofuel credits. The credit originally applied to fuels produced after December 31, 2024, and sold before December 31, 2027, rewarding lower lifecycle GHG emissions with a value ranging from $0.20 to $1.00 per gallon (or up to $1.75 for sustainable aviation fuel), depending on compliance with wage, apprenticeship, and lifecycle carbon intensity requirements.[399]

Key Changes Over Time

- Original (IRA, 2022): Created to combine previous tax credits for biodiesel, renewable diesel, and sustainable aviation fuel into a unified emissions-based incentive focused on reducing transportation fuel GHG footprint.[400]
- 2025 Changes (OBBBA): The One Big Beautiful Bill Act extended the credit through 2029 (from 2027), clarified feedstock and emissions eligibility, allowed for ongoing use of Renewable Energy Certificates (RECs) to reduce reported lifecycle emissions, updated producer/facility qualifications, and mandated that eligible feedstocks come from North America.[401]
- Current Features: The credit is fully transferable, usable by biofuel and SAF producers, and is calculated only for fuels with less than 50 kg CO_2e per MM BTU. Regulatory guidance now requires thorough emissions tracking (using GREET or CORSIA models) and annual claiming on tax returns, rather than through periodic cash advances.[402]

Current Industry Impact

- **Market Growth:** The extension ensures several more years of planning certainty and market stability for biofuel and clean fuel investments, encouraging innovation and facility upgrades for emissions reduction.[403]

- **Producer Strategy:** Producers are making strategic investments in lower-carbon technologies, carbon capture, and renewable electricity procurement to maximize their credit value. Many are leveraging "credit stacking" with state Low Carbon Fuel Standard (LCFS) programs.[404]

- **Agricultural Effects:** U.S. farmers could benefit through increased demand for climate-smart feedstocks, with price support for crops like corn, soy, and other oilseeds. However, credit pass-through to growers is not mandated and depends on market dynamics.[405]

- **Compliance Complexity:** The industry faces higher compliance and documentation costs due to rigorous lifecycle tracking and stricter IRS registration, but the value of credits is more directly aligned with actual emissions reductions.[406]

USDA "smart agriculture" (or climate-smart agriculture, CSA) provisions

USDA "smart agriculture" (or climate-smart agriculture, CSA) provisions focus on supporting and verifying farm practices that lower greenhouse gas (GHG) emissions from crop production, thereby reducing the carbon intensity (CI) scores of biofuels made from these feedstocks.

Key CSA Provisions

- In January 2025, the USDA issued interim technical guidelines for climate-smart agriculture crops used as biofuel feedstocks, including corn, soy, and sorghum (USDA 1.16.25[407])

- These guidelines establish clear standards for quantifying, reporting, and verifying the GHG impact of farm-level practices such as reduced tillage, cover cropping, nutrient management, and use of nitrification inhibitors (USDA 1.16.25).

- USDA has also launched the Feedstock Carbon Intensity Calculator, which enables producers to calculate farm-scale CI reflective of the new standards.[408]

Impact on Biofuel Carbon Intensity Scores

- Farms that adopt and verify CSA practices can achieve significantly lower CI scores for their crops.[409]

- Lower CI scores mean that resulting biofuels are eligible for higher incentives under federal programs like the 45Z producer credit and Low Carbon Fuel Standard (LCFS)-type programs.[410]

- This framework allows U.S. biofuels to better compete in clean fuels markets, benefiting both producers [through increased value] and agriculture [through new technical and market support] (USDA 9.17.25[411]).

- By making carbon reduction measurable and auditable at the farm level, these guidelines also boost the credibility of environmental claims and open up broader international trade opportunities for low-carbon commodities (USDA 9.17.25).

Current Industry Momentum

- Over 25 million acres of U.S. farmland are covered under climate-smart commodity partnerships, with projects enrolling farmers for these practices and verification protocols (USDA 9.17.25).
- Studies suggest that widespread CSA adoption could reduce global agricultural emissions by 4–8 billion metric tons per year, and U.S. biofuel producers are already structuring contracts to reward participating farms for lower CI feedstocks.[412]

Change in the Indirect Land Use Change Penalty

Recent USDA and federal legislative changes have addressed the ILUC penalty—specifically, the treatment of ILUC in biofuel carbon intensity (CI) scoring. Under the latest One Big Beautiful Bill Act (OBBBA) and Section 45Z guidance, the controversial ILUC factor has been excluded from the CI calculation used to determine eligibility and value for the clean fuel producers credit.

Previously, biofuels made from conventional U.S. crops, such as corn and soy, were penalized due to assumptions about international land conversion resulting from expanded crop demand; this penalty was widely criticized as speculative and inconsistent. Starting in 2026, only direct emissions from feedstock production and processing count toward the CI score for 45Z, resulting in lower carbon intensity scores for U.S. grain and oilseed biofuels and boosting their competitiveness and credit value. However, ILUC remains included in other programs, such as the federal Renewable Fuel Standard (RFS), resulting in temporary inconsistencies across federal biofuel policy frameworks.[413]

Context, Perspective, Outcomes, and Impact

Context: Federal legislative and regulatory actions have repeatedly set the stage for states to innovate in clean fuel policy. The Inflation Reduction Act's Section 45Z Clean Fuel Production Credit and its extension under the One Big Beautiful Bill Act created a unified, lifecycle-based incentive framework that rewards producers for reducing greenhouse gas emissions while reinforcing USDA's climate-smart agriculture guidelines.

These changes have shifted the focus from theoretical land-use penalties toward measurable, verifiable practices that lower feedstock carbon intensity, while encouraging farmers to adopt cover crops, reduced tillage, and nutrient management. Together, these provisions have provided the federal precedent and technical infrastructure to support lower-carbon fuels and justify state-level action.

Perspective: For Maryland, these federal signals help overcome two of the state's biggest public education and policy barriers: the outdated "food vs. fuel" myth and the lingering penalty for land-use change. With ILUC excluded from 45Z scoring and with farm-level carbon reductions verifiable through USDA's new standards, Maryland can credibly incorporate biofuels as both a clean energy and agricultural resilience strategy.

The Maryland Department of the Environment has relied heavily on the EPA's MOVES model for emissions accounting. Still, federal recognition of GREET as the benchmark lifecycle model strengthens the case for MDE to supplement MOVES with GREET. Doing so would ensure a complete well-to-wheel assessment, align Maryland with federal best practices, and provide the technical justification for adopting a Low Carbon Fuel Standard that reflects the true benefits of ethanol, biodiesel, and other low-carbon fuels. This approach not only aligns with federal precedent but also positions Maryland as a leader in applying rigorous, transparent lifecycle analysis to decarbonize its transportation sector.

Outcome and Impact: The USDA's latest rules provide the crucial technical and market infrastructure needed to scale production of lower-carbon biofuels using climate-smart growing practices, which strengthens the case for biofuels' role in decarbonizing transportation.[414] In summary, the Section 45Z Clean Fuel Production Credit has become more valuable, longer-lasting, and stricter in its emissions focus, driving new investment and evolution in the U.S. biofuels and clean fuels sectors in 2025.[415]

E15 RVP Waiver

Reducing Aromatics is More Important than Reducing RVP

Why the RVP Waiver Issue Exists

Under the Clean Air Act Amendments of ***1990***, summertime gasoline (June 1–Sept 15) must meet Reid Vapor Pressure (RVP) limits to reduce smog formation. Congress granted a one psi "RVP waiver" for E10 (10% ethanol), recognizing its benefits for fuel supply and emissions. However, E15 (15% ethanol) was not included in the original waiver **because it was not commercially used in 1990**. This left E15 subject to stricter RVP limits, effectively barring sales in many states during the summer months.

Timeline of the E15 Waiver

2011: EPA approves E15 use in model year 2001 and newer cars/light trucks, which covers ~97% of gasoline sold.

2019: EPA under the Trump Administration issues a rule extending the E10 RVP waiver to E15, allowing year-round sales.

2021: The D.C. Circuit Court vacates the 2019 rule, ruling EPA lacked authority to extend the waiver without Congressional action.

2022–2024: In response to high fuel prices and energy security concerns, the EPA issued temporary emergency waivers allowing E15 sales each summer (granted in 2022, 2023, and 2024).

2025: EPA finalized a request from Midwest governors (eight states) to allow E15 year-round in their states starting summer 2025 permanently, but nationwide summer sales still rely on temporary waivers.

How Many Times?

Since the 2021 court decision, the EPA has issued three consecutive annual summer waivers (for 2022, 2023, and 2024) to permit nationwide E15 sales from June to September.

In the future, Midwest states will have permanent authority starting in 2025, while the rest of the country will depend on annual emergency waivers unless Congress amends the Clean Air Act.

Context, Perspective, Outcomes, and Impact

Context: The RVP waiver issue stems from the Clean Air Act's original exemption for E10 but not E15. After EPA's 2019 attempt to fix it was overturned in court, E15 summer sales have depended on temporary emergency waivers (three times so far). Permanent solutions are now partial (Midwest states) but not nationwide.

EPA's current Reid Vapor Pressure (RVP) volatility standard for gasoline prevents gasoline marketers from offering year-round blends of gasoline containing 15% ethanol (E15/88-Octane).

Perspective: For decades, the EPA's focus on reducing Volatile Organic Compound (VOC) emissions, also known as RVP, has had diminishing returns, as new vehicle technology and refueling systems already effectively control evaporative emissions. Meanwhile, aromatic hydrocarbons (benzene, toluene, xylene) remain the dominant source of toxic tailpipe emissions, secondary particulates, and urban smog precursors. Reducing aromatic content through higher ethanol blends would deliver far greater health and climate benefits than further tightening vapor pressure standards—while simultaneously supporting domestic fuel production and consumer choice.

Outcomes and Impacts

Why Maryland Needs a Waiver

- The Clean Air Act sets a federal standard for Reid Vapor Pressure (RVP) during summer months (June 1–Sept 15).
- Only Congress or EPA can provide exceptions. States cannot unilaterally decide to waive RVP limits.
- Without a waiver, Maryland retailers legally cannot sell E15 in the summer unless it meets the tighter RVP spec, which is generally not available in the commercial fuel supply.

Impact of No Waiver

- **Consumer Access:** Drivers in Maryland would lose summertime access to E15 (~10–30 cents cheaper per gallon), while neighboring states with waivers (like PA or VA, if granted) would enjoy the benefit.
- **Market Competitiveness:** Maryland's biofuel retailers would be disadvantaged, limiting sales and slowing LCFS-related emission reductions.
- **Carbon Reduction:** Maryland would miss out on the ~2–3% additional carbon savings E15 delivers compared to E10, making it harder to meet state climate goals.

Could Maryland "ignore" the requirement?

- If Maryland allowed E15 sales without a waiver, retailers and distributors would violate the Clean Air Act.

EPA Enforcement Tools:

- EPA could issue civil penalties against suppliers and stations (up to ~$50,000 per day per violation).
- EPA could also restrict Maryland's federal highway funds or SIP (State Implementation Plan) approvals if the state refused to enforce federal fuel standards.
- In extreme cases, DOJ could sue on EPA's behalf for Clean Air Act violations.

Realistic Path for Maryland

- ☑ Maryland could join the Midwest states' petition model (approved in 2025) by asking the EPA to opt out of the E10 waiver and align its state RVP rules with those of the Midwest states.
- ☑ Alternatively, Maryland could pursue a state LCFS that works in tandem with GREET lifecycle modeling. However, for RVP, it still requires EPA approval or a congressional change.

If Maryland doesn't get a waiver, it cannot legally sell E15 in the summer without risking EPA enforcement and fines. The state cannot "just ignore" the rule. The viable pathway is to petition the EPA, as the Midwest governors have done, to align fuel specifications so that E15 can be sold year-round.

Can Maryland or its residents sue the EPA?

Yes, but the pathway is narrow and complex. Maryland or its residents could sue the EPA under the Clean Air Act, much like Massachusetts v. EPA established for greenhouse gases. The case would argue that the EPA is endangering public health by maintaining fuel standards that perpetuate higher emissions of benzene and carbon. However, the legal bar is high, and a more practical path may be through regulatory petitions or a Maryland-specific LCFS.

- **Standing:** Plaintiffs (Maryland, its Attorney General, or private citizens) would need to show *concrete injury* from EPA's action or inaction — e.g., higher carbon emissions or toxic exposure leading to measurable health impacts.
- **Statutory Authority:** EPA regulates fuels and emissions under the Clean Air Act (CAA). Challenges must be argued that EPA is failing its statutory duty to protect public health and welfare (CAA Sec. 202, 211).
- **Precedent:** Courts have recognized citizen suits under the CAA (42 U.S.C. §7604). States also routinely sue the EPA (or other federal agencies) for failing to regulate pollutants — e.g., Massachusetts v. EPA (2007), in which the Supreme Court held that the EPA must regulate greenhouse gases if they endanger public health.
- **Toxic Aromatics (BTEX):** The argument could lean on EPA's own acknowledgment that benzene is a carcinogen with no safe threshold, combined with the Clean Air Act's mandate to reduce toxic emissions "to the greatest degree achievable."

Challenges to such a lawsuit

- **Causation & Specific Harm:** Plaintiffs must link EPA's *failure to act on E15/LCFS or fuel reformulation* directly to increased exposure or climate damage — courts often find this difficult to prove.
- **EPA Discretion:** EPA has broad discretion under the CAA; if EPA claims it is following the law as written (e.g., limited by the statutory RVP waiver for E10 only), courts are often reluctant to override.
- **Remedy:** Even if successful, the outcome would likely be a demand directing EPA to reconsider rules, not direct damage or compensation.

Strategic Alternative

- Instead of suing, states like Maryland can petition EPA for regulatory changes (like the Midwest governors' petition for permanent E15 waivers).
- Maryland could also adopt a state Low Carbon Fuel Standard (LCFS) and build its justification on EPA's and DOE's own science (e.g., GREET modeling, toxic aromatic reductions). This would sidestep litigation delays while still protecting residents.

National Context: The Nationwide Consumer and Fuel Retailer Choice Act (NCFRC)

The NCFRC has a legislative history spanning over a decade, with multiple reintroductions aimed at enabling year-round sales of gasoline blended with 15% ethanol (E15).

Feasibility

The legislation is bipartisan, bicameral legislation would extend **{remove}** the Reid Vapor Pressure (RVP) volatility waiver **{current restriction}** to enable **{not mandate}** the year-round sale **{consumer choice}** of E15 **{in 2011 EPA approved E15 for use in vehicles 2001 and newer representing 97% gasoline sold}.**

The Act could provide a permanent solution to the regulatory barrier that **restricts** gasoline retailers **from offering consumers the choice** to purchase a **{according to March 2025 California Air Resources Board study}** lower-priced, higher-octane fuel that reduces particulate matter (PM) **{carcinogen}**, carbon monoxide, total hydrocarbons {BTEX/ aromatics./carcenogen}), non-methane hydrocarbons (GHG), and carbon dioxide {GHG} emissions. The expanded market for agricultural products will help sustain the value of farmland, preventing it from being converted to commercial and industrial applications, which would increase carbon dioxide and other GHG emissions. [416]

Legislative Timeline

2015: First introduced by Senator Deb Fischer (R-NE).

2017: Reintroduced as the Consumer and Fuel Retailer Choice Act, seeking to amend the Clean Air Act's RVP standard.

2019: President Trump supported RVP for E15. The court challenges stalled the implementation.

2021–2023: Reintroduced in the 117th, 118th but failed to advance.

2025: Reintroduced in the 119th Congress by Sen. Fischer (D) and Rep. Smith (R) with 10 Republicans, 8 Democrats, and bipartisan House backing. [417] [418]

Key Provisions

Market Barrier: Resolves the number one regulatory barrier to the increased use of biofuels nationwide by 50%.

Uniformity: Replaces temporary EPA waivers with a statutory solution to avoid regulatory patchwork.

Market Certainty: Creates a permanent year-round solution.

Support and Opposition

Bipartisan coalition including farm groups (Nebraska Corn Growers, Renewable Fuels Nebraska), oil industry (American Petroleum Institute), and retailers (National Association of Convenience Stores).[419] (Opposition)Democrats are concerned about environmental impacts, though 4 House Democrats voted in favor.

- 2025 House Floor Vote: While committee votes are not detailed in available sources, the House passed its version (H.R. 22) on April 10, 2025.[420]
  - Yeas: 220 (216 Republicans, 4 Democrats)
  - Nays: 208 (208 Democrats, 0 Republicans)
  - Not Voting: 5

National Context: Clean Air Act Amendments of 1990 (CAAA) and Next Generation Fuels Act (NGFA)

The Clean Air Act Amendments of 1990 (CAAA) granted the EPA the authority to regulate 188 hazardous air pollutants (HAPs), including those from mobile sources such as cars, trucks, and buses.[421] Provisions reflect a tiered approach that combines fuel standards, emissions modeling, and health-driven pollutant prioritization to mitigate mobile source air toxics (MSATs). Congress mandated the EPA to take action to reduce emissions contributing to urban air pollution, including carbon monoxide, benzene, and diesel particulate matter.[422]

Table 63: CAAA Mobile Source Air Toxic (MSAT) Overview

Aspect	Key Details
Priority MSATs	9 high-risk pollutants (e.g., benzene, diesel PM)
Modeling	MOVES3 is required for emissions analysis since 2023
Reduction Targets	330,000 tons MSATs by 2030 via 2007/2025 rules
Health Focus	Cancer, respiratory, and cardiovascular risks from diesel PM and VOCs
	Summary and Sources. [423] [424] [425] [426]

Section 202 authorizes the EPA to set standards for emissions from new motor vehicles and engines, including criteria pollutants and hazardous air pollutants. The EPA is instructed to consider factors like cost, technological feasibility, and the availability of technologies when developing and enforcing these standards.

- **Section 202(a)(1):** "The Administrator ***shall*** by regulation prescribe (and from time to time revise) in accordance with the provisions of this section, standards applicable to the emission of any air pollutant from any class or classes of new motor vehicles or new motor vehicle engines, which in his judgment cause, or contribute to, air pollution which may reasonably be anticipated to endanger public health or welfare. [427]"

- **Section 202(l)(2):** "Regulations under this subsection ***shall*** contain standards for such vehicles and fuels to achieve the greatest degree of emission reduction achievable through the application of technology which will be available, taking into consideration compliance costs, energy impacts, and safety factors.". [428] This includes mandating changes in fuel formulations (e.g., reducing aromatic hydrocarbons) or requiring advanced vehicle technologies.[429] [430] [431]
    a. Availability of technology {yes}
    b. Costs to implement the standards {cheaper than not}
    c. Energy and safety considerations. {not doing uses more energy and is less safe}

Outcomes: Health Effects Institute Mobile-Source Air Toxics: A Critical Review of the Literature on Exposure and Health Effects Special Report 16, published in 2007, is a comprehensive report that evaluates the health effects of exposure to 21 mobile-source air toxics (MSATs) as defined by the 2001 EPA mobile-source rulemaking. It provides a critical analysis of the literature for a subset of seven MSATs—acetaldehyde, acrolein, benzene, 1,3-butadiene, formaldehyde, naphthalene, and polycyclic organic matter—and assesses research gaps and unresolved questions within the current regulatory context.[432] The Federal Highway Administration (FHWA) updated the Interim Guidance MSAT analysis in NEPA documents in 2023.

Oxygenated Fuel Program: Implemented in 1992, the CAAA required 39 areas, Which Were Carbon monoxide (CO) nonattainment areas that exceeded federal CO air quality standards, to modify their state gasoline standards. The new standard required gasoline to contain a minimum of 2.7% oxygen by weight during the winter months (usually from October 1 to March 31). This was achieved by blending conventional gasoline with oxygenates, such as ethanol, methanol, MTBE, ETBE, or TAME.[433] [Note: There are only two oxygenated fuels, ethanol and MTBE. The EPA began phasing out MTBE in 2000, and it was banned in 2006.[434]

☑ **Outcome & Impact:** All areas were redesigned to be attained by September 27, 2010.[435] [436]

Reformulated Gasoline Program: Implemented in 1995, the CAAA required states to improve the national gasoline standard by EPA-mandated reductions in Volatile Organic Compound (VOC) emissions through limitations on aromatics and blending oxygenates.[437] [Note: Ethanol or MTBE. MTBE was phased out and then banned in 2006. [438] The EPA mandate was enforced in nine metropolitan areas with the highest levels of ozone, as designated by the CAAA. Dallas–Fort Worth, Texas, and areas in Kentucky, Missouri, and Virginia were not classified as severe nonattainment but voluntarily opted into the RFG Program. By the end of 1995, approximately 25% of gasoline sold in the U.S. was required to meet the RFG program standards, with 17 states and the District of Columbia mandating participation in the program either voluntarily or through mandatory measures.

- ☑ **Outcome & Impact:** According to the EPA, the first phase of the RFG program reduced VOCs and air toxics by 17% and NOx emissions by 1.5% compared to 1990 levels.[439] Areas participating in the RFG program reported measurable improvements in compliance with National Ambient Air Quality Standards (NAAQS) for ozone and particulate matter. The reductions in VOCs, NOx, and air toxics improved public health by decreasing exposure to smog and hazardous pollutants. By reducing VOCs, air toxics, and NOx, the RFG program indirectly contributed to lower secondary particulate matter formation, which is beneficial for respiratory and cardiovascular health. VOCs are precursors to ozone formation. Reformulated gasoline significantly reduced VOC emissions by limiting the evaporation of gasoline and lowering emissions during combustion.[440] Modifications to gasoline composition, particularly through the addition of oxygenates such as ethanol, affect emissions of ozone precursors, including volatile organic compounds (VOCs), nitrogen oxides (NO_x), and carbon monoxide (CO).[441]

Why and How?

Aromatics: Octane enhancers, such as benzene, Toluene, Methylbenzene, Ethylbenzene, and Xylene dimethylbenzene (BTEX), are the most carbon-intensive and carcinogenic compounds in gasoline. They have relatively low volatility compared to other gasoline components, such as light alkanes. Gasoline with high levels of aromatics tends to evaporate less readily than gasoline with more volatile components, such as butane. However, high aromatic content does not inherently prevent evaporation; instead, it alters the volatility profile of the fuel. Fuel blending to reduce overall volatility (measured by Reid Vapor Pressure, or RVP) is a more direct factor in controlling evaporation.

Combustion Contributions: High levels of aromatics increase VOC emissions during incomplete combustion. Aromatics tend to produce higher amounts of unburned hydrocarbons because their complex molecular structure is more difficult to burn completely.[442]

Evaporative Contributions: While aromatics evaporate more slowly than lighter hydrocarbons, any evaporation still contributes to VOC emissions. The high molecular weight of aromatics can make these emissions more persistent and potentially more reactive in the atmosphere, leading to smog formation.[443]

Refinery Adjustments: Gasoline with high aromatics typically requires blending with other components to optimize volatility and combustion properties.[444] These adjustments can indirectly influence evaporative emissions. {Data Gap: Is it the inability to add BTEX to RBOB that causes economic hardship for small refiners?}

- ☑ **Outcome and Impact:** The RFG Program mandates reductions in both evaporative and tailpipe VOC emissions. It limits explicitly aromatic content in gasoline to improve air quality. Blending oxygenates (e.g., ethanol) with gasoline reduces aromatic content, thereby lowering VOC emissions from combustion and improving fuel properties like RVP. -- EPA's Technical Overview of the Effects of Reformulated Gasoline on Air Quality.[445] The EPA estimates that approximately 75 million people now breathe cleaner air than in 1995, in part due to reductions in emissions from RFG.

Renewable Fuel Standard

Discussions to establish a Renewable Fuel Standard started before the Energy Policy Act of 2003.[446] The RFS was a response to a confluence of events, geopolitical concerns, economic, energy, and environmental security [Similar to the current state in Maryland]

Economic Security:

- National security threats and oil dependency post-9/11.
- Rising oil prices and economic vulnerability tied to foreign oil.
- Environmental and health concerns from petroleum use.
- The desire to stimulate rural economies and create domestically produced energy alternatives to imported fossil fuels and electricity.

Economic Pressures: During the early 2000s, oil prices began to rise significantly. While prices fluctuated, they generally trended upward from $18/barrel to $50–60 per barrel in 2005. Rising oil prices increased costs for consumers and businesses, underscoring the economic vulnerability associated with oil dependency.

Rural Economic Support: The RFS was also designed to stimulate rural economies by creating a steady demand for biofuel crops, such as corn. This provided economic benefits to agricultural states and contributed to energy diversification.

Air Quality and GHG Emissions: Congress viewed renewable fuels as a way to improve air quality and reduce greenhouse gas (GHG) emissions. Ethanol and other biofuels were seen as cleaner alternatives to gasoline, with the potential to mitigate climate change and reduce urban air pollution. By incentivizing biofuel production, Congress aimed to diversify energy sources, support rural economies, and reduce the environmental impact of transportation fuels.

The Renewable Fuel Standard (RFS) has a history of success in driving biofuel production and adoption, supporting rural economies, and reducing greenhouse gas (GHG) emissions. However, its progress is hindered by a combination of technological, ideological, and governmental challenges.

Table 64: Renewable Fuel Standard Legislative History and Production Targets

Year/Timeframe	Event/Details
1999-2005	Members of Congress advocated federal standards to incentivize the use of renewable oxygenates in gasoline. By the early 2000s, the debate evolved into formal legislative proposals to establish a national Renewable Fuel Standard.
2005	**Energy Policy Act of 2005 (RFS1).** [447]
	Enactment: Signed into law by President George W. Bush.
	Scope:
	Mandated 4 BGPY of renewable fuel blending in 2006 and 7.5 BGPY by 2012. Focused primarily on corn-based ethanol and established the first federal requirements for blending biofuels.
	Administration: EPA implemented rules in 2007, including the Renewable Identification Number (RIN) system for tracking compliance.
2007	**Energy Independence and Security Act of 2007 (RFS2).** [448]
	Enactment: Expanded RFS with bipartisan support, despite concerns about ethanol's environmental and food-price impacts.
	Key Changes
	Volume Targets: Increased annual requirements to 36 BGPY by 2022, with sub-categories:
	Conventional biofuels (corn ethanol): 15 BGPY cap by 2022.
	Advanced biofuels (e.g., cellulosic, biodiesel): 21 BGPY by 2022, requiring 50-60% GHG reduction vs. petroleum.
	Sustainability Criteria: Mandated lifecycle greenhouse gas (GHG) reductions for each fuel category.
Post-2022	**Regulatory Actions**
	Statutory Gap: The original RFS2 targets ended in 2022, requiring the EPA to set volumes annually.
	2023–2025 Final Rule Volumes
	2023: 20.94 BGPY
	2024: 21.54 BGPY
	2025: 22.33 BGPY (includes 1.38 BGPY of cellulosic biofuel).
	Delayed eRINs: A proposed pathway for renewable electricity (from biogas) to qualify was postponed.
	Compliance: Maintained RIN trading and penalties for non-compliance.
	Key Legislative Timeline
2005	The Energy Policy Act establishes RFS1
2007	The Energy Independence and Security Act expanded the RFS2
2015	The EPA frequently misses statutory deadlines, resulting in lawsuits and delayed rulemaking.
2022	Statutory RFS2 targets expire; EPA begins multi-year rulemaking.
2023	A final rule for 2023–2025 has been published, emphasizing cellulosic biofuels and delaying the implementation of eRINs.

National Context and Perspective: Next Generation Fuels Act (NGFA)

Context: At the federal level, the Renewable Fuel Standard (RFS) has been the backbone of U.S. biofuels policy for nearly two decades, delivering over 320MMT of CO_2 reductions and more than $100 billion in consumer fuel cost savings. Yet the program has also been subject to persistent litigation, political swings, and structural challenges — from small refinery exemptions to missed statutory deadlines. The stalled progress of the Next Generation Fuels Act

(NGFA) reflects both the ongoing recognition of ethanol's role in displacing toxic aromatics and the entrenched resistance of petroleum interests that argue against infrastructure costs and potential impacts on fuel prices. If the RFS were to be weakened or repealed, the result would be a significant loss of emissions reductions, rural economic support, and investment, indeed undoing decades of progress toward cleaner fuels.

Perspective: Maryland faces the same opposition narratives that have slowed federal action. Petroleum interests warn about higher costs and infrastructure burdens, even though most new tanks and pumps are already compatible with mid-level blends. Upgrades are driven by credit card security standards, regardless of fuel choice. Claims about food vs. fuel or speculative land-use change echo national talking points long used to cast doubt on biofuels, despite USDA's climate-smart agriculture guidelines and the exclusion of ILUC from 45Z lifecycle scoring. For Maryland, the lesson is clear: just as federal policy has had to overcome decades of entrenched opposition, state leaders must view these barriers as familiar tactics rather than insurmountable challenges. By aligning its policies with GREET lifecycle modeling and supplementing EPA's MOVES, Maryland can establish a transparent and defensible Low Carbon Fuel Standard that protects public health, strengthens rural economies, and accelerates decarbonization, even if federal progress remains uneven.

Research

In September 2020, U.S. Congressional Representative Cheri Bustos (D-IL) introduced H.R.8371, titled the "Next Generation Fuels Act of 2020," to establish a high-octane, low-carbon fuel standard by directing the Environmental Protection Agency (EPA) to create a new 98 Research Octane Number (RON) standard. The bill sought to limit the amount of "toxic aromatic hydrocarbons" in fuels. The legislation also called for updating regulations governing fueling infrastructure. The bill would expand the availability of mid-level ethanol blends, such as E15 (15% ethanol) and E30 (30% ethanol). The bill did not advance to a vote in committee.

Environmental and Public Health Security

- About 20% of gasoline is comprised of "aromatic" octane enhancers, e.g., **B**enzene, **T**oluene Methylbenzene, **E**thylbenzene, and **X**ylene dimethylbenzene (**BTEX**). BTEX are the most carbon-intensive and carcinogenic compounds in gasoline. [449]
- The US Department of Health and Human Services (DHHS) classifies benzene as a human carcinogen.[450] "It is generally considered that the only absolutely safe concentration for benzene is zero." American Petroleum Institute, 1948.
- A 2013 assessment by WHO's International Agency for Research on Cancer (IARC) concluded that outdoor air pollution is carcinogenic to humans, with the particulate matter component of air pollution most closely associated with increased cancer incidence, especially lung cancer. [451]
- The high aromatic fuels produced greater total carbonaceous aerosol and secondary organic aerosol (SOA) than the low aromatic fuels. More SOA formation is expected

from current GDI vehicles when operated with gasoline fuels rich with heavier aromatics and blended with higher ethanol levels. SOAs are a significant component of fine particulate matter ($PM_{2.5}$),

- High-octane, high-carbon BTEX carcinogenic compounds would be displaced by increasing the percentage of 109 octane ethanol.
- Lower Carbon and Mobile Source Air Toxic (MSAT) Emissions: April 2025, the California Air Resources Board (CARB) study shows statistically significant reductions in emissions from particulate matter, carbon monoxide, total hydrocarbons, non-methane hydrocarbons, and carbon dioxide when switching from E10 to E15. [452]

Energy and Economic Security

Time to Market: Refueling Infrastructure - Most new storage tanks and pumps are already compatible. Credit card companies are requiring retail fueling stations to update their dispensers to accept new chip and PIN secure credit cards by October 2017, at which time fraud liability would switch to station owners if they have not updated their equipment. [453]

Legislative Timeline

September 2020: H.R. 8371 (116th Congress): The proposed legislation was referred to the House Committee on Energy and Commerce but did not advance to a vote.

August 2021: H.R. 5089 (117th Congress): The proposed legislation was referred to the House Energy and Commerce Committee and the Ways and Means Committee but did not advance to a vote. [454] [455]

July 2022: S. 4621 (117th Congress): U.S. Senator Chuck Grassley (R-IA) introduced a Senate companion bill to H.R. 5089. The proposed legislation referred to the Senate Finance Committee but did not advance to a vote.

March 2023: H.R. 2434 & S. 944 (118th Congress): The proposed House of Representatives legislation referred to the House Committee on Energy and Commerce and the Subcommittee on Environment, Manufacturing, and Critical Materials, but did not advance to a vote. The U.S. Senate companion bill, S. 944, introduced by U.S. Senators Amy Klobuchar (D-MN), Chuck Grassley (R-IA), Joni Ernst (R-IA), and Tammy Duckworth (D-IL), was read twice and referred to the Committee on Environment and Public Works. Still, it did not advance to a vote.

A**s of April 2025**, the Next Generation Fuels Act remains active but not enacted. It continues to be introduced in each congressional session, reflecting ongoing bipartisan interest in promoting high-octane, low-carbon fuels. However, it has not yet passed through both chambers of Congress or been signed into law.

Perspective: RFS and LCFS Technological Challenges are Aligned

Cellulosic Biofuel Production: The RFS sets ambitious targets for advanced biofuels, particularly cellulosic biofuels, which require substantial technological innovation to produce at scale. Despite years of research and investment, production volumes remain far below targets due to high costs, technical barriers, and limited infrastructure.

Infrastructure Constraints: The U.S. lacks widespread infrastructure for higher ethanol blends, such as E15 or E85, which limits market access and consumer adoption. This affects the ability to meet blending mandates and integrate renewable fuels into the broader transportation sector.

Vehicle Compatibility: Concerns persist about compatibility with older vehicle engines and fueling systems, which some stakeholders argue discourages broader adoption of ethanol blends.

RFS Governmental and Regulatory Challenges and Market Barriers

Inconsistent Policy Implementation: Delays and missed statutory deadlines by the EPA in setting annual RFS volumes create uncertainty for industry stakeholders, discouraging investment and innovation. For example, EPA's failure to meet the 2026 RFS volume deadline has resulted in lawsuits from biofuel industry groups.

Small Refinery Exemptions (SREs): The EPA's handling of SREs has been a source of controversy. While small refineries claim they need exemptions to remain financially viable, biofuel advocates argue that widespread exemptions dilute the RFS's impact and undermine its goals.

Changing Political Priorities: The RFS has bipartisan origins, but political polarization and shifting administrations have led to inconsistent support and enforcement of the program. Under some administrations, there has been a stronger focus on electrification rather than biofuels as the primary strategy for decarbonization.

Electrification Policy Emphasis: Federal policies and funding increasingly prioritize electric vehicles (EVs) over biofuels, potentially sidelining the RFS. Critics argue that a more integrated approach could combine the strengths of both EVs and biofuels to achieve climate goals.

Challenges to EPA's CAFE, Clean Vehicle, and Emissions Standards

Ideological Divisions

Fossil Fuel vs. Renewable Energy Advocacy: The American Petroleum Institute (API) and other fossil fuel industry groups view the RFS as a threat to their market share and argue against its mandates. They claim the policy imposes unfair burdens on refineries and overstates the environmental benefits of biofuels.

Environmentalist Concerns: While biofuels reduce GHG emissions, some environmental advocates argue that land-use changes for biofuel crop production, such as deforestation or monoculture farming, undermine these benefits.

Food vs. Fuel Debate: The use of food crops, such as corn, for ethanol production has sparked criticism that it raises food prices and contributes to global food insecurity. This ideological opposition influences legislative and regulatory decisions.

Table 65: Challenges to EPA's Vehicle Emissions Standards

Category	Plaintiffs	Allegations	Status
Light- and Medium-Duty Vehicle Emissions (2027–2032)	API, National Corn Growers Association, American Farm Bureau Federation, and a coalition of auto dealers.	EPA's emissions standards for light- and medium-duty vehicles are claimed to exceed its authority, effectively mandating a shift to EVs, potentially eliminating gasoline-powered and hybrid cars, impacting consumers, manufacturers, and energy security.	A lawsuit was filed in the D.C. Circuit Court of Appeals. Sources: Reuters, Rigzone, API.
Heavy-Duty Vehicle Emissions (2027–2032)	API, National Corn Growers Association, American Farm Bureau Federation, and the Owner-Operator Independent Drivers Association.	The standards for heavy-duty vehicles are argued to be technologically unfeasible and economically burdensome, prioritizing electrification over biofuels, which could harm rural communities and the agricultural sector.	A lawsuit was filed in the D.C. Circuit Court of Appeals—sources: Climate Change Litigation, Rigzone, API.

Table 66: Disputes with EPA Over the Renewable Fuel Standard (RFS)

Category	Plaintiffs	Allegations	Status
Delay in Setting 2026 RFS Volumes	Clean Fuels Alliance America.	The EPA missed the statutory deadline for 2026 RFS volumes, creating uncertainty for the biofuels industry and hindering investment and growth.	Clean Fuels filed a lawsuit in December 2024 to compel the EPA to establish a timeline—sources: Clean Fuels Alliance America, KFGO.
Inadequate Biomass-Based Diesel Volumes (2024–2025)	Clean Fuels Alliance America.	The EPA set volumes significantly below industry capacity and trends, undermining the biodiesel industry's growth and sustainability.	A petition was filed in June 2024, requesting that the EPA reconsider the set volumes. Sources: Reuters, Clean Fuels Alliance America, Federal Register.
Denial of Partial Waiver for 2023 Cellulosic Biofuel Standard	American Fuel & Petrochemical Manufacturers (AFPM).	AFPM requested a partial waiver due to production shortfalls. The EPA denied this request, leading AFPM to argue that the agency failed to meet its non-discretionary duty under the Clean Air Act.	AFPM filed a lawsuit in the U.S. District Court for the District of Columbia in August 2024. Sources: Ethanol Producer Magazine, Climate Change Litigation, US EPA.
Denial of Small Refinery Exemptions (SREs) for 2022	Small oil refineries, including Sinclair Wyoming Refining Company.	The EPA's denial of numerous SREs for 2022 is argued to impose financial burdens that threaten refinery viability. Plaintiffs claim the EPA's actions were arbitrary and failed to consider individual circumstances.	In July 2024, the U.S. Court of Appeals for the District of Columbia ruled against the EPA's denial of the 2022 SREs and remanded the matter for reconsideration. Sources: Reuters.

Table 67: The Costs, Benefits, and Trade-offs of Increased Renewable Fuel Use

Rank	Category	Impact	Impact
5	Greenhouse Gas Emissions	Reduction	320 MMT CO_2e since 2007 through fossil fuel displacement.[456]
		Offset	~24% gains lost to land-use change (LUC) emissions from corn farming1
		Advanced biofuels	50–60% reduction in GHG emissions compared to petroleum. [457] [458]
3	Air Pollutants	PM2.5	4,200+ tons reduced (California LCFS).[459]
		Nox	25,500+ tons reduced (California LCFS).[460]
		Carcinogens	Reduced benzene/formaldehyde in urban areas.[461]
1	Health Benefits	Lives saved	1,100+ premature deaths/year avoided. [462] 880 projected by 2025 (California).[463]
		Hospital visits	457k fewer asthma cases, 38k fewer attacks/year.[464]
		Workdays	75k+ saved.[465]
2	Economic Savings	Healthcare	$7.5–8.3B/year saved.[466]
		Climate disasters	$1.8–3.8B cumulative savings.[467]
		Fuel costs	$100B+ saved by 2025.[468]
4	Carbon Emissions	Intended	36B gallons of renewable fuel by 2022, cutting 320MMT CO_2e [469]
		"Unintended"	637–831 g CO_2e/L ethanol from LUC (exceeds gasoline)
6	EV Equivalency	Actual Zero Emissions = Cars removed	69M gasoline vehicles' annual emissions offset (~320MMT CO_2e).[470]
Positive		Positive	Cleaner air, energy security, and rural economic growth
		Negative	LUC emissions, fertilizer runoff, and water quality decline.[471] [472]

RFS Outcome & Impact

The RFS's effectiveness and 20-year track record of success demonstrate its potential to reduce emissions and bolster rural economies. However, ideological opposition, technological hurdles, and regulatory inconsistencies hinder its progress. Addressing these barriers will require:

- A balanced approach that supports biofuels alongside electrification.
- Investments in technology to overcome production and infrastructure challenges.
- Consistent, timely regulatory actions to build stakeholder confidence and advance the program's goals.

Opportunity to Leverage Federal Legislation and Regulations to Justify Adopting a Clean Lower-Carbon & Lower-Carcinogenic Fuel Standard (CLC-CFS)

The Clean Air Act and its 1990 amendments require EPA to act when fuels or vehicle emissions endanger public health, mandating the most significant achievable reductions through available technologies (Clean Air Act, 42 U.S.C. §7521, Sec. 202(a)(1); 202(l)(2), 1990).[473] The scientific consensus on benzene has been clear since 1948—its only safe concentration is zero; yet, toxic aromatics remain a significant component of gasoline and diesel fuel.[474] Maryland's pursuit of a Low Carbon Fuel Standard aligns with this federal framework by leveraging proven, cost-effective alternatives, such as ethanol, that cut aromatics, reduce carbon emissions, and protect consumers. This approach extends the Clean Air Act's legacy while delivering cleaner air, safer fuels, and measurable economic benefits.

Maryland's CAAA, RFG, RFS, and LCFS Relevance Check List

- ☑ Availability of technology ***[Yes]***
- ☑ Costs to implement the standards ***[Cheaper, Better, Faster, Safer - than status quo]***
- ☑ Energy and safety considerations. ***[Non-action uses more energy, creates more carbon, and is higher risk]***

Cleaner

A California Air Resources Board (CARB) report from April 2025 states that increasing the amount of ethanol in gasoline from 10% to 15% (E10 to E15) results in significant reductions in particulate matter, carbon monoxide, total hydrocarbons, non-methane hydrocarbons, and carbon dioxide.

Lower Carbon

Producing sub-octane gasoline for ethanol blending increases refinery output by about 3–5% per barrel of crude and reduces carbon emissions in the production step by 5–10% per gallon.

Table 68: Justification for a Clean Low-Carbon Low-Carcinogen Fuel Standard

Fuel / Blendstock	Refined Yield / Energy Balance	GHG Refinery or Life-Cycle Savings
84 Octane Blendstock	+3–5% per barrel refinery yield gain	5–10% less CO_2 emissions, refining only. (EIA)
Ethanol (E10–E30, GREET model)	Displaces aromatics; high octane allows lower refinery energy intensity	44–52% lower lifecycle GHG emissions vs. gasoline (DOE Argonne GREET)
Biodiesel (B20–B100, GREET model)	Derived from soy, canola, waste oil, etc., lowers the need for aromatics in diesel fuel	40–86% lower lifecycle GHG emissions vs. petroleum diesel (DOE Argonne (GREET)

Data Table Sources[475]

Lower Carcinogenic

Premium gasoline blends can contain aromatics in the range of 25–35% by volume, compared to 20–25% in regular gasoline. Aromatic octane enhancers, commonly referred to as BTEX compounds, e.g., Benzene, Toluene (methylbenzene), Ethylbenzene, and Xylene (dimethylbenzene) (BTEX), are the most carbon-intensive and carcinogenic components in gasoline.

Context: Sections of the Clean Air Act Amendments of 1990 (CAAA) Relevant to MD LCFS

Benzene/Aromatic Reduction Context

CAAA Section 202 authorized the EPA to establish standards for emissions from new motor vehicles and engines, including criteria pollutants and hazardous air pollutants. The EPA is directed to consider factors such as cost, technological feasibility, and the availability of technologies when implementing and enforcing these standards.

- ☑ Section 202(a)(1): "The Administrator ***shall*** by regulation prescribe (and from time-to-time revise) in accordance with the provisions of this section, standards applicable to the emission of any air pollutant from any class or classes of new motor vehicles or new motor vehicle engines, which in his judgment cause, or contribute to, air pollution which may reasonably be anticipated to endanger public health or welfare. "

- ☑ CAAA Section 202(l)(2): "Regulations under this subsection ***shall*** contain standards for such vehicles and fuels to achieve the greatest degree of emission reduction achievable through the application of technology which will be available, taking into consideration compliance costs, energy impacts, and safety factors.". This includes mandating changes in fuel formulations **(e.g., reducing aromatic hydrocarbons) or requiring advanced vehicle technologies.**

References for API's 1948 review that set a safety threshold for benzene at "zero."

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*"As far back as **1948**, the API's toxicological profile of the chemical discussed … 'the only absolutely safe concentration … is zero.'"* Galbraith, David, Sherilyn A. Gross, and Dennis Paustenbach. "Benzene and Human Health: A Historical Review and Appraisal of Associations with Various Diseases." Critical Reviews in Toxicology 40, no. S2 (**2010**): 1–46.

"In 1948, a toxicological review prepared for the American Petroleum Institute by the Harvard School of Public Health concluded that 'the only absolutely safe concentration for benzene is zero." Morris, Jim. "The Science on Benzene Keeps Getting Scarier. Industry Remains in Denial." Public Health Watch, **December 21, 2023.**

"That was a conclusion reached in a 1948 toxicological review of benzene prepared for the American Petroleum Institute, a trade association." Kristen Lombardi and Jared Bennett. "A Dozen Dirty Documents." Center for Public Integrity, **December 5, 2014.**

*At the **2025** Fuel Ethanol Workshop & Expo (FEW), Dr. Steffen Mueller received the Award of Excellence for his academic and policy contributions to the ethanol industry. His work includes research on the health impacts of replacing toxic aromatics, such as benzene, in gasoline with ethanol.*

Context, Perspective, Impact, and Outcomes

Context: Since the passage of the Clean Air Act and its 1990 amendments, Congress has given EPA the authority to regulate fuels and vehicle emissions with the explicit goal of protecting public health and welfare. Section 202 requires the Administrator to set standards when pollutants "may reasonably be anticipated to endanger public health." In contrast, Section 202(l)(2) directs the agency to achieve the greatest feasible emissions reductions by changing fuel formulations or vehicle technologies. The legislative framework is clear: when toxic substances like benzene are present, the response must be grounded in prevention and the deployment of available, safer technologies. The scientific record reinforces this mandate. As far back as 1948, the American Petroleum Institute's own toxicological review concluded that "the only absolutely safe concentration for benzene is zero."

Perspective: These provisions of the Clean Air Act provide both the legal and moral justification for states like Maryland to pursue a Low Carbon Fuel Standard. With ethanol and other low-carbon fuels already proven and widely available, Maryland can meet the statute's criteria of technology availability, cost-effectiveness, and safety. Dr. Steffen Mueller's recognition at the 2025 Fuel Ethanol Workshop highlights the health benefits of replacing carcinogenic aromatics with ethanol—a solution that delivers cleaner air, reduces carbon emissions, and lowers consumer costs. Just as the Clean Air Act once set the national framework for cleaner fuels and vehicles, a Maryland LCFS can serve as a practical extension of that legacy, closing the gap between what we know about fuel toxicity and what we allow at the pump.

Outcomes and Impact: Protect Status Quo or Go Forward

- If Maryland adopts an LCFS, it could potentially reduce carbon by ~3MMT tons per year and increase economic activity and consumer savings by ~$5 $5B per year.

- If Maryland fails to adopt an LFCS, it will hurt the economic, energy, environmental, food, and personal security of its residents and the national security of the nation.

Section 11: Opportunities and Recommendations for Maryland to Increase the Use of Biofuels to Lower Carbon Emissions

Summary

Maryland stands at a pivotal moment in its energy and climate strategy. As transportation remains the state's largest source of greenhouse gas emissions, adopting higher biofuel blends offers both immediate and long-term benefits. Building on precedents set by states like California, Maryland has the opportunity to lower fuel costs, improve public health, and advance its Climate Solutions Now Act goals while supporting local farmers and enhancing energy security. The challenge is not just technical, but also educational: ensuring consumers and policymakers understand the total societal value of biofuels as part of a balanced clean energy portfolio.

Key Insights

- **Economic Savings:** Biofuels can reduce pump prices by 20–40 cents per gallon, generating hundreds of millions in annual household savings.
- **Climate Alignment:** Higher blends accelerate progress toward Maryland's climate commitments, cutting emissions immediately while electrification scales.
- **Security Benefits:** Biofuels strengthen food and energy security by sustaining farmland values, supporting farmers, and reducing dependence on foreign oil.
- **Public Health & Equity:** Expanded use in high-burden communities can lower pollution hotspots and deliver cleaner air where it is needed most.
- **Public Awareness Priority:** Consumer education is essential to unlock adoption; awareness campaigns must frame biofuels as *Cheaper, Better, Faster, Safer*.

Opportunities to Support the Increased Use and Production of Biofuels

This section breaks down and clarifies where policy tools, incentive programs, and infrastructure investments overlap or diverge for the two principal biofuels, highlighting the importance of tailored approaches while aligning support for universal infrastructure and education.

There are several ways Maryland's state agencies can support biofuels through a targeted mix of infrastructure investments, incentives, regulatory actions, and outreach. Multiple case studies highlight effective strategies from across the U.S.

Context: Successful State Case Studies Supporting Biofuels

Iowa: Leveraged infrastructure incentives (grants for fuel pumps, tanks, and storage), coupled with mandates for E15/E85 availability at selected stations, resulting in the country's highest per-capita ethanol and biodiesel use and extensive production capacity.

Illinois: Implemented property and sales tax exemptions for biodiesel production facilities and fuel sales, which led to increased local consumption; direct incentives for companies were especially effective.

Minnesota: Mandated minimum biodiesel blends (10-20%) in all diesel sold, supported by grants for infrastructure, which drove statewide adoption and accelerated the state's GHG reduction in transportation.

California: A combination of low-carbon fuel standards, financial incentives, fleet requirements, and project grants is used to accelerate the use of advanced biofuels and foster innovative, commercial-scale projects. The results include the large-scale production of renewable diesel and lower lifecycle carbon emissions.

Missouri: Offered tax rebates for jobs created by biodiesel plants and exempted certain feedstock sales from sales tax, successfully expanding both local production and use.

Key Insights

- Policies that target infrastructure and production incentives and are available to private sector companies (not just government fleets) show higher statewide biofuel consumption.
- Incentives for infrastructure (such as retail pumps, storage, and blending equipment) paired with regulatory certainty (including blending mandates and procurement requirements) are most strongly associated with adoption and market stability.
- Dedicated funding at the state level, such as through the USDA Higher Blends Infrastructure Incentive Program (HBIIP), has shown measurable success in increasing both production and consumer access.
- These approaches provide a proven roadmap for how state agencies can advance both the supply and demand sides of the biofuels sector, leveraging a combination of incentives, infrastructure support, and strategic mandates to achieve maximum impact.

Opportunities for Maryland to Support Biofuels

1. Adopting Cleaner Fuel, Lower Carbon, or Lower Aromatic Fuel Standards.
2. Public education, marketing, and promotional campaigns aimed at increasing awareness and demand for biofuels.
3. Minimum blend or procurement requirements for state vehicle and commercial transportation fleets (biofuel blends in government purchasing, commercial use, or public transit)

4. Public funding/subsidies for fuel supply infrastructure (e.g., installation of retail/fleet refueling pumps and storage — E15/E85/B20/B100 pumps).
5. Grants or loan guarantees for building or upgrading biofuel production plants and feedstock facilities.
6. Tax incentives or exemptions for biofuel producers and users, including relief for facility construction and fuel sales.
7. Research and development/commercialization grants for advanced biofuels, including new feedstocks or production pathways.
8. Partnerships and cooperative programs among producers, farmers, and blenders to secure supply chains.
9. Producer/retailer checkoff programs: sector-wide assessments (similar to corn/soybean checkoffs) to fund marketing, research, infrastructure, and consumer outreach for all renewable fuels (biofuels).

Ethanol-Specific Programs, Ideas, & Concepts

1. Grants/incentives for installation or upgrading of infrastructure specific to higher ethanol blends (E15, E85) at retail stations and convenience stores.
2. Support/funding for the construction and feedstock supply of corn and cellulosic ethanol plants.
3. Tax exemptions and property tax relief specifically for ethanol production facilities.
4. Minimum ethanol blend mandates or procurement requirements for gasoline (E10/E15) — potentially extended to public or private fleets.
5. State fleet and public procurement programs encouraging or mandating the use of flex-fuel vehicles (FFVs) and E85.
6. Grants or subsidies for the installation of blender pumps to expand E15/E85 access at stations.
7. Research/commercialization grants for advanced ethanol (cellulosic, algae).
8. Public education campaigns highlighting the air quality, octane, and engine performance benefits of ethanol.

Biodiesel-Specific Programs, Ideas, & Concepts

1. Grants/incentives for distribution or infrastructure upgrades focused on biodiesel blending (B20, B100 pumps) at terminals, fleet depots, and retail sites.
2. Property or sales tax relief for biodiesel plant construction and expansion, as well as for feedstock supply.
3. Biodiesel minimum blend mandates/regulations for on-road diesel (e.g., B10, B20), especially in state or municipal fleets.
4. Job creation tax incentives, sales tax exemptions for biodiesel facility employees, and in-state feedstock suppliers.
5. Fleet or state transit procurement rules prioritizing high blend biodiesel.

6. Specialized outreach or education grants to fleet operators, school bus systems, or public transit for emissions and operational benefits.
7. Research/grant funding for new biodiesel feedstocks (waste oils, non-edible oils, and winter crops, etc.).
8. Support the Development of a B20 Club Program

Ways Maryland Agencies Could Collaborate to Support Biofuels

Cataloged by Support Area

1. Advocating for and Implementing Statewide Minimum Blend Requirements
    a. Maryland General Assembly: Holds legislative power to enact mandates for minimum biofuel blends statewide.
    b. Governor's Office: May issue executive orders to set or accelerate statewide blend targets.
    c. Board of Public Works: May review and approve major executive orders or contracts tied to fleet standards.
    d. Maryland Department of the Environment: May have the authority to issue a clean fuel standard rulemaking.
2. Managing and Awarding Grants or Loans to Private Fuel Retailers
    a. Maryland Energy Administration (MEA): Primary agency for energy-related grants and incentives, including support for private fuel retailers for biofuel infrastructure or uptake.
    b. Other Agencies: Occasionally, the Department of the Environment (MDE) or the Department of Commerce, or specialized revolving funds, may participate in or coordinate grant programs.
3. Issuing or Managing Checkoff Programs for Fuel Producers or Retailers
    a. Maryland General Assembly: Would need to pass authorizing legislation to create a checkoff program and set its terms.
    b. Designated State Agency (potentially the MEA or Department of Agriculture): May administer the program once established, subject to legislative oversight.
    c. Streamlining Permitting for New Production Infrastructure
    d. Maryland Department of the Environment (MDE): Holds primary permitting authority for environmental compliance, air quality, and often operational permits for new energy production.
    e. Department of Planning, Department of Transportation (MDOT): Serve consultative roles, especially for site access, infrastructure integration, and highway-related projects.
4. Establishing State-Level Procurement or Fleet Requirements Beyond MDOT's Fleet
    a. Maryland Department of Budget and Management (DBM): Sets procurement policy and oversees statewide fleet management rules for executive agencies.

b. The Maryland General Assembly or the Governor's Office May issue legislation or executive directives that specify statewide procurement standards.

5. Directing the Use of Tax Exemptions, Incentives, or Retail Mandates
    a. Maryland General Assembly: Holds statutory authority for tax policy, retail mandates, and primary incentive program changes.
    b. Relevant State Agencies (e.g., Comptroller, MEA, Department of Commerce): Administer and implement these policies once authorized by statute.

Most high-impact policy shifts (such as mandates, major grants, or checkoff programs) require explicit legislative action by the Maryland General Assembly, with implementation delegated to agencies like MEA, MDE, DBM, or the Board of Public Works. MDOT leads on its own fleet, public education, and infrastructure within its properties, but depends on interagency or legislative action for broader, sector-wide changes.

Cataloged by Office and Agency

Opportunities for Maryland State Agencies to Support Increased Biofuel Use

1. Office of the Governor
    a. Executive Orders impacting/supporting economic, energy, environmental, food, personal, and national security.
    b. The legislature and/or the governor provide necessary resources for research and carry out the Maryland Commission on Climate Change Mitigation Working Group recommendation to adopt a clean fuel standard.
    c. Coordinate cross-agency collaboration on the support areas outlined below and public service announcements.
2. Maryland Department of Agriculture
    a. Public Education
        i. Maryland Biofuels Information Center
    b. Fuel Retailer Support
        i. Collaboration on a Fuel Retailer Engagement Survey with Weights and Measures
        ii. Content labeling for country of origin and biofuel, aromatics, and BTEX content.
        iii. Octane and BTEX content testing
    c. Priority Investment List: Dispensers and USTs that already meet the requirements for higher blends.
    d. Research and development grants for feedstock innovation (waste oils, non-edible crops).
    e. Support for the 45Z Climate Smart Clean Fuel Producer Tax Credit.
    f. Study the impact of the check-off program for fuel retailers and biofuel producers.

    g. B20 Club support and recognition.
3. Maryland Department of the Environment
    a. Continued research to support the Mitigation Working Group's recommendation to adopt a clean fuel standard.
    b. Clean Fuel, Clean Heat rulemaking.
    c. Public engagement and PSA support.
    d. Air quality testing at street level.
    e. Accelerated environmental permitting for infrastructure investment.
    f. As part of the Vehicle Emissions Inspection Program (VEIP) role, incorporate a Flexible Fuel Vehicle (FFV) identification and education program.
    g. Make biofuels eligible for the electric vehicle program incentives for hard-to-decarbonize vehicles.
    h. B20 Club support and recognition.
4. Maryland Department of Health
    a. Include health effects information on the agency website and collaborate on a cross-agency PSA campaign.
    b. BTEX blood testing for high-exposure at-risk jobs, including highway workers, parking garage attendants, fast-food drive-through workers, and those in heavily trafficked areas such as 495, 395, 301, the Bay Bridge, and the Baltimore Tunnel.
5. Maryland Department of Energy
    a. Grants and incentives for distribution facility upgrades and installation of high-biodiesel blend pumps (B20, B100), focused on terminals, depots, and fleet fueling centers.
    b. Provide public education support to help consumers develop a better understanding of fuel competition and the economics of supply and demand.
    c. B20 Club support and recognition.
6. Maryland Comptroller
    a. Department of General Services (DGS), specifically through its Office of State Procurement (OSP). Oversight and approval authority for major contracts lies with the Maryland Board of Public Works, which includes the Governor, Treasurer, and Comptroller.
    b. Study the feasibility of specific biofuel purchasing requirements in state-owned vehicle fleets and public transit systems, and biobased products, i.e., biobased astroturf as an alternative to petroleum-based, biobased straws and plastic bags,
    c. The Maryland Department of Budget and Management (DBM),
    d. The DBM's Fleet and Travel Management Unit oversees the acquisition, operation, and maintenance of state vehicles and could collaborate on a state Fleet Administrator Engagement Survey.
    e. Field Enforcement Bureau (COMP) is responsible for enforcing signage and price-disclosure requirements on retail dispensing equipment, ensuring fuel

dispensers carry proper grade labels and consumer information, and conducting laboratory fuel quality testing (octane, oxygenates, contaminants) at retail stations and terminals. Incorporate a fair and reasonable standard for labeling gasoline dispensers regarding the content of biofuels and why, including the reduction of aromatics and BTEX content, and posting the amount of fuel.

7. Maryland Department of Transportation
    a. Leverage the "state fuel card" data to identify the best locations for future infrastructure investments to increase biofuel blends (E15/E85, B20/B100) in MDOT-owned vehicles and facilities.
    b. Prioritizing the purchase of biofuel-compatible vehicles for MDOT's fleets.
    c. Installing or upgrading fueling infrastructure for biofuels at MDOT-owned sites (e.g., highway rest stops, maintenance facilities), and piloting public access where possible.
    d. Educating agency employees, transit contractors, and public users about biofuel benefits.
    e. Participating in demonstration and pilot programs (e.g., a Maryland B20 Club) that involve MDOT-owned or MDOT-contracted fleets.
    f. Coordinating public awareness campaigns relating to transportation or public fleets.
8. The Maryland Motor Vehicle Administration (MVA).
    a. Incorporate Flexible Fuel Vehicle identification and education as part of the state inspection program.
    b. The MVA sets the curriculum, certifies commercial driving schools, and oversees compliance with all driver education requirements for new drivers in the state. MVA could encompass the economic, energy, environmental, food, personal, and national security implications of gasoline and diesel, as well as the benefits that biofuels, alternative fuels, and energy-efficient vehicles provide.
    c. MVA could incorporate gasoline, diesel, and biofuel awareness into the driver's education curriculum and include it in the driver's license test. (See Stakeholder Engagement D.R.I.V.E. Quiz)
    d. Like driving and under the influence and no texting while driving, and Click-it-or-ticket campaigns, MVA could incorporate public health benefit messaging about biofuels as part of a public safety campaign.
9. Department of General Services
    a. Biobased product procurement requirements.
    b. Biofuel-based product procurement requirements.
10. Maryland Department of Commerce
    a. Revolving fund support

Table 69: Cross-Agency Collaboration to Support the Increased Use and Production of Biofuels

Policy/Opportunity	GO	MGA	MDE	MEA	MDA	DBM	MDOT	COMP	COM	BoPW
Adopting clean, low-carbon, low-aromatic fuel standards	X	X	X							X
Public education/marketing on biofuels	X			X	X		X			
Minimum blend/procurement requirements for fleets	X	X				X	X			X
Funding/subsidies for fueling infrastructure				X					X	
Grants/loans for biofuel plants/feedstock facilities				X	X				X	
Tax incentives and exemptions for producers/users/facilities		X						X		
R&D/grants for advanced biofuels				X	X					
Partnership/co-op programs (producers, farmers, blenders)				X	X				X	
Biofuel/retailer checkoff program (creation/enactment)		X								
Biofuel/retailer checkoff program (admin/oversight)				X	X				X	
Blender pump/E15/E85 ethanol infrastructure grants				X	X		X			
Corn/cellulosic ethanol plant funding				X	X				X	
Ethanol tax exemptions & property tax relief		X						X		
Gasoline/E10/E15 blend minimum		X	X							
FFV fleet procurement, ID, and education.		X	X				X			
B20/B100 infrastructure grants				X	X		X			
Biodiesel plant/feedstock incentives, job credit		X						X	X	
Diesel/B10/B20 blend minimums		X	X							
Fleet/bus operator outreach (biofuels, air quality, etc.)					X		X			
B20 Club support/recognition				X	X		X			
State fleet procurement (standards, implementation, reporting)						X	X			X
Streamlining permitting for production infrastructure			X				X			

Table 70: Maryland Agencies & Entities That Produce or Support PSAs

Entity	Role in PSAs / Communications	Sample Campaigns or Topics	Notes / Contact Info
Maryland State Ad Agency (MSAA)	Statewide ad/communications/marketing arm that produces PSAs, manages media buys, and supports state agencies in messaging	988 crisis hotline awareness (with MDH) museaward.com, problem gambling campaign museaward.com, opioid/substance abuse, and Covid campaigns.	Division of Maryland Public Television (MPT) MSAA -+1; handles creative, media, and strategy for state agency clients.
Maryland Department of Health (MDH)	Initiates health- or behavior-oriented public health PSAs; often the "client" for MSAA or external contractors	988 crisis line awareness museaward.com, problem gambling awareness museaward.com	Partner with MSAA for production and distribution
Maryland Public Television (MPT)	Distribution partner & affiliate network; supports state broadcasting, digital distribution of PSAs	Serves as a home platform for MSAA and its campaigns	MPT's enabling statute allows it to provide support to state agencies via MSAA
Maryland Public Service Commission (PSC)	Communicates regulatory, consumer, and utility-related PSAs, press releases, and public notices	Public information about utility proceedings, consumer alerts, and the Public Service Commission of Maryland	PSC's Communications & Media Relations office handles PSA / press release output, Public Service Commission of Maryland
Local / County Public Information / PIO Offices	For more localized PSAs (public safety, health, traffic, emergencies)	Example: Montgomery County Police Department PIO uses PSAs / media alerts for crime, safety, and emergencies, Montgomery County, MD	These offices issue regionally targeted PSAs, especially for police, fire, health, and disaster events
Municipal Government Towns)	City-level PSAs (safety, fire prevention, community alerts)	The City of Annapolis has a "PSAs – Public Service Announcements" page covering fire safety, slip prevention, and smoke alarms.	PSAs often operate via city websites, social media, and local cable/public access channels.
Office of the State Fire Marshal	Fire safety, prevention, and emergency communication campaigns	Fire prevention, smoke alarm campaigns, and wildfire awareness	Under the Maryland Department of State Police
Natural Resources / Environmental Agencies	Conservation, wildlife, waterway safety, and environmental educational PSAs	Boating safety, fishing regulations, and habitat conservation	Maryland Natural Resources Police (under DNR) may also engage in outreach

Table 71: Maryland Agencies & Programs with Energy/Clean Fuel/Environmental PSA Potential

Agency / Program	Existing Outreach / PSA Role	Sample Campaigns, Topics, or Activity	Key Contact or Mechanism	Notes & Opportunity for Biofuel / Clean Fuel Messaging
Maryland Department of the Environment (MDE)	Runs an Outreach, Education & Events program for environmental topics (air, water, land) Department of the Environment+2Maryland News+2	Exhibits at fairs, educational materials, press releases, social media, "Marylander" initiatives, and the Department of the Environment	Lisa Jones, Communications & Outreach Manager, MDE Office of Communications (410-537-3172) Department of the Environment	Because MDE already handles environmental messaging, it is a natural home for clean fuel or biofuel PSAs tied to air quality, climate, or emissions reductions.
Maryland Commission on Climate Change, ECO Working Group	Handles Education, Communication & Outreach for the state's climate change program, including public webinars on MCCC recommendations, Department of the Environment	"Commission Talk" webinar series, public comment sessions, and climate communication	Jared Williams, Climate Change Policy Analyst, MDE (serves ECO) Department of the Environment	ECO could explicitly incorporate clean fuel/biofuel messaging (e.g., emissions, lifecycle carbon) into its climate outreach.
Maryland Public Service Commission (PSC)	Issues consumer-oriented PSAs regarding energy markets, utility choices, and regulation.	The "MD Energy Choice" program provides PSAs in English & Spanish to inform customers about electricity and gas supplier choices.	PSC's Communications & Media Relations office	PSC's "MD Energy Choice" site is a working example of an energy-oriented PSA effort. They could expand to PSAs about biofuels, low-carbon energy, or fuel diversification.
Maryland Energy Administration (MEA)	Oversees state energy policy, programs, grants, and equity in energy; already doing outreach on equity/electrification	The "Affordable Electrification Outreach Program," "Energy Efficiency Equity Grant Program," and community solar / EV charging equity components of the Maryland Energy Administration	Director: Paul G. Pinsky (MEA Director)	MEA is a prime candidate to promote PSAs about clean fuels/biofuel roles in a diversified energy strategy, or to partner with MDE / MSAA to design campaigns.
Local / County PIO / Environmental / Planning Offices	Local governments frequently issue public notices, localized PSAs (e.g., "Buy local energy" or "air quality alerts")	While not always centrally documented, many counties run air quality alerts, conservation messaging, and energy efficiency programs.	Varies by country (e.g., communications or environmental departments)	Local PSAs can complement state-level messaging and also allow for tailored messaging (e.g., targeting biofuel stations in specific counties).

Recommendation 1: Clean Fuel Standard Recommendation

Support the Maryland Climate Change Commission's Mitigation Working Group recommendation to adopt a clean Fuel standard.

California's decision to authorize year-round E15 blending sets a powerful precedent for states like Maryland. By aligning fuel standards with modern technology and consumer demand, California is unlocking both cost savings and climate benefits. For Maryland, where transportation accounts for over a third of carbon emissions and consumers face some of the nation's highest gasoline prices, adopting similar reforms could:

- Lower fuel costs by 20–40 cents per gallon, saving Maryland drivers $500–$750M annually.
- Accelerate climate goals under the Climate Solutions Now Act, leveraging biofuels as an immediate decarbonization tool.
- Strengthen energy and food security by sustaining farmland values, keeping cropland in production, and preventing the "double-whipsaw" of farmland loss and higher-carbon imports.
- By following California's lead, Maryland can position biofuels as a bridge solution—providing immediate economic relief and long-term resilience while electrification continues to scale.
- Maryland farmers produce cleaner fuels, cleaner vehicles, cleaner cities, cleaner communities, and healthier ag economies.

Recommendation 2: Increase Consumer Awareness and Public Education

Regardless of federal or state mandates, regulatory waivers, or even lower pump prices, consumers must still make a choice—whether to buy a higher biofuel blend or to vote for or against leaders who failed to provide that choice. This makes public education and consumer awareness the top priority for all stakeholders.

Biofuels cannot achieve their full economic, environmental, and security benefits without informed consumers who understand both the options available and the consequences of inaction. In the hierarchy of importance, public education is the foundation: it builds demand, strengthens advocacy, and ensures that policy decisions are aligned with the public will, rather than being stalled by confusion, misinformation, or a lack of awareness.

Ways Maryland Could Support a Consumer Awareness and Public Education Campaign

1. Develop a cross-agency action plan.
    a. Incorporate biofuels production and use strategy into related agency strategic plans and policies.
    b. Expand the use of state agency websites to provide clear, accessible information about FFVs, biofuel availability, and related public service announcements (PSAs).
    c. Coordinate efforts among MDE, MDOT/MVA, and other agencies to educate consumers, fleets, and the public about the benefits and availability of biofuels.
    d. Support the creation of a Maryland Biofuels Information Center to serve as a shared online resource and to ensure consistent messaging across state agencies.
    e. Update the MVA driver's education curriculum and driver's license testing to include information on how fuel choices impact economic, energy, environmental, national, food, and personal security.
2. Support Driver Education and FFV Awareness
    a. Integrate FFV identification into the MVA's vehicle registration process and provide consumer-friendly resources showing where FFVs can use higher-blend biofuels.
    b. Incorporate FFV awareness into the MDE Vehicle Emissions Inspection Program (VEIP), providing consumers with information on renewable fuels at inspection stations.
    c. Strengthen retail dispensing and fuel quality standards by requiring transparent and consistent labeling of grade, blend, and renewable fuel content at retail dispensers.
    d. Developing a transparent standard for biofuel labeling that explains reductions in toxic aromatics (BTEX) and highlights the health, environmental, and security benefits. Conduct regular laboratory testing of fuels at retail stations and terminals to ensure compliance with standards for quality, octane, oxygenates, and contaminants.
3. Support Infrastructure Development and Investment
    a. Conduct surveys of fuel retailers to identify optimal locations for renewable fuel dispensers and to assess technical and financial needs.
    b. Survey public and private fleets to target priority sites for refueling infrastructure investment.
    c. Share state fleet fueling card data with relevant agencies to identify high-volume fueling areas where renewable fuel infrastructure would have the greatest impact.
    d. Establish a revolving fund, supported by Volkswagen settlement funds or other automobile-related environmental penalties, to finance grants, incentives, and low-interest loans for renewable fuel infrastructure development.

Messaging

The Total Society Benefits of Biofuels

The Oxygenated Fuel and Reformulated Gasoline Programs in the 1990 Clean Air Act Amendments, and later the Renewable Fuel Standard in the 2005 and 2007 Energy Policy Acts, all share one thing in common:

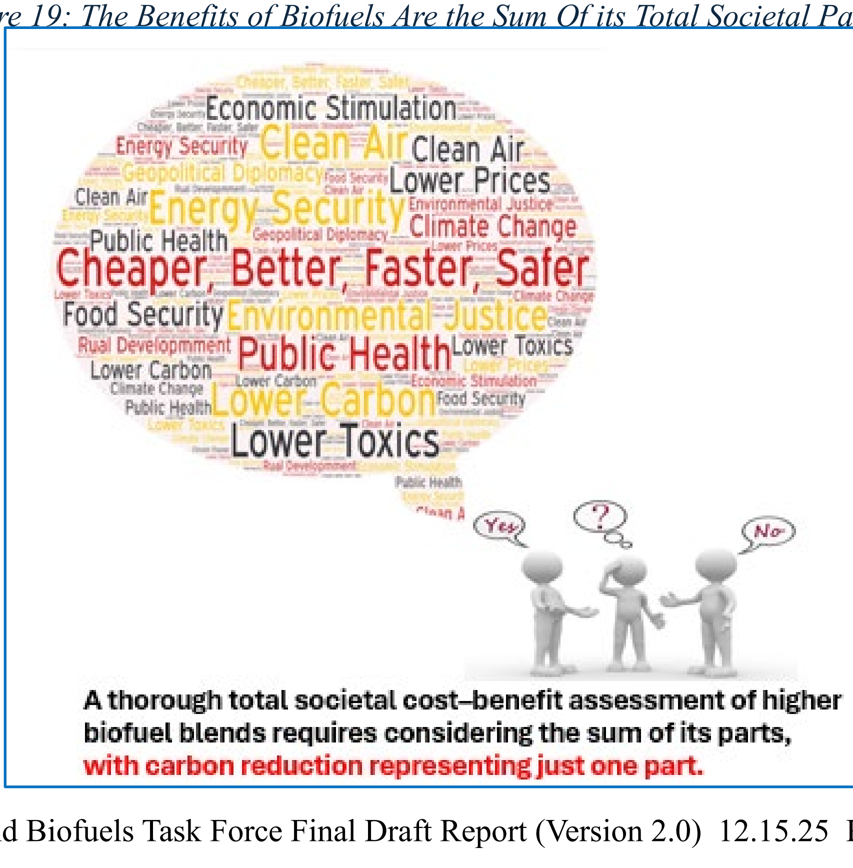
- ☑ The expanded use of biofuels to strengthen economic, energy, environmental, national, food, and personal security. Reducing carbon emissions is just one more part of the cost-benefit puzzle of creating federal clean fuel programs.

Cashing in on the Payback from Paying Forward

Stanford University's Woods Institute for the Environment study showed reduced air pollution (specifically, reductions in ozone, particulate matter, nitrogen dioxide, and sulfur dioxide) between 1999 and 2019 contributed to about 20% of the increase in U.S. corn and soybean yield gains during that period, an amount worth approximately $5B per year.

> *"We already know that the Clean Air Act resulted in trillions of dollars of benefits in terms of human health, so I think of these billions in agricultural benefits as icing on the cake. But even if it's a small part of the benefits of clear air, it has been a pretty big part of our ability to continue pushing agricultural productivity higher.*" study lead author David Lobell, dlobell@stanford.edu, https://youtu.be/gOCSa2eAzEM.[476]

Figure 19: The Benefits of Biofuels Are the Sum Of its Total Societal Parts



Public Health Benefits and Savings from the Clean Air Act Amendments of 1990

Biofuels, embedded in successive federal fuel programs, created cumulative economic, energy, environmental, national, food, and personal security benefits—building the bipartisan support needed to set cleaner fuel standards.

Bipartisan Support Focus: By integrating oxygenated and renewable fuels into multiple federal programs, biofuels generated broad-based bipartisan support for cleaner fuel standards that delivered measurable public benefits.

Circular Benefits Focus: Biofuels generate a wide range of benefits—serving as pillars of economic, energy, environmental, national, food, and personal security. These pillars reinforce one another cumulatively and circularly – benefits from one pillar enabling benefits from the next – collectively strengthening the most important U.S. policy objectives.

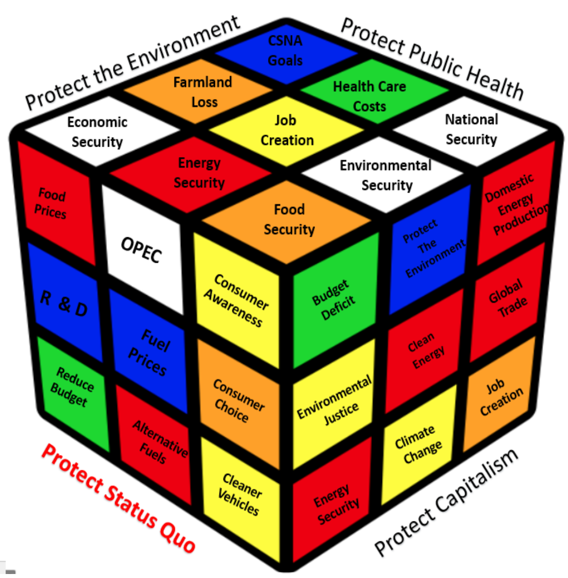
Public Value Focus: Each fuel program's biofuel component helped the public capture value beyond lower emissions—spanning lower costs, stronger energy security, healthier communities, and resilient farmland—making sustained bipartisan action possible.

Long-Term Standards Focus: It was the multifaceted and reinforcing impacts of biofuels that enabled policymakers to move from short-term fixes to long-term federal fuel standards, ensuring the public could capture enduring benefits across all sectors of security.

Solving the Clean Fuels Policy Rubik's Cube: Every Move You Make Every Breath You Take

Crafting sustainable energy policy is akin to solving a Rubik's Cube: every move affects multiple sides simultaneously. Policymakers must balance energy security, environmental protection, economic costs, budgets, R&D, consumer awareness and perception, as well as national security considerations. Each decision can bring one side closer to alignment, but only science-based innovation can bring the whole cube into balance.

Figure 20: Clean Fuels Policy Rubik Cube



Biofuels offer a proven path toward that alignment. Yet too often, leaders have defaulted to the status quo—framing inaction as cost avoidance—while history shows the actual cost of inaction is always higher. Transportation fuels, like tobacco, carry hidden societal costs that consumers ultimately bear through higher taxes, health care expenses, and insurance premiums.

Research demonstrates that federal clean fuel programs, especially their biofuels components, have not only reduced harmful pollutants but also lowered fuel, food, and feed prices. Like a 401(k) portfolio, Maryland now has an opportunity to invest in its agricultural sector and reap dividends while the cost of entry remains low.

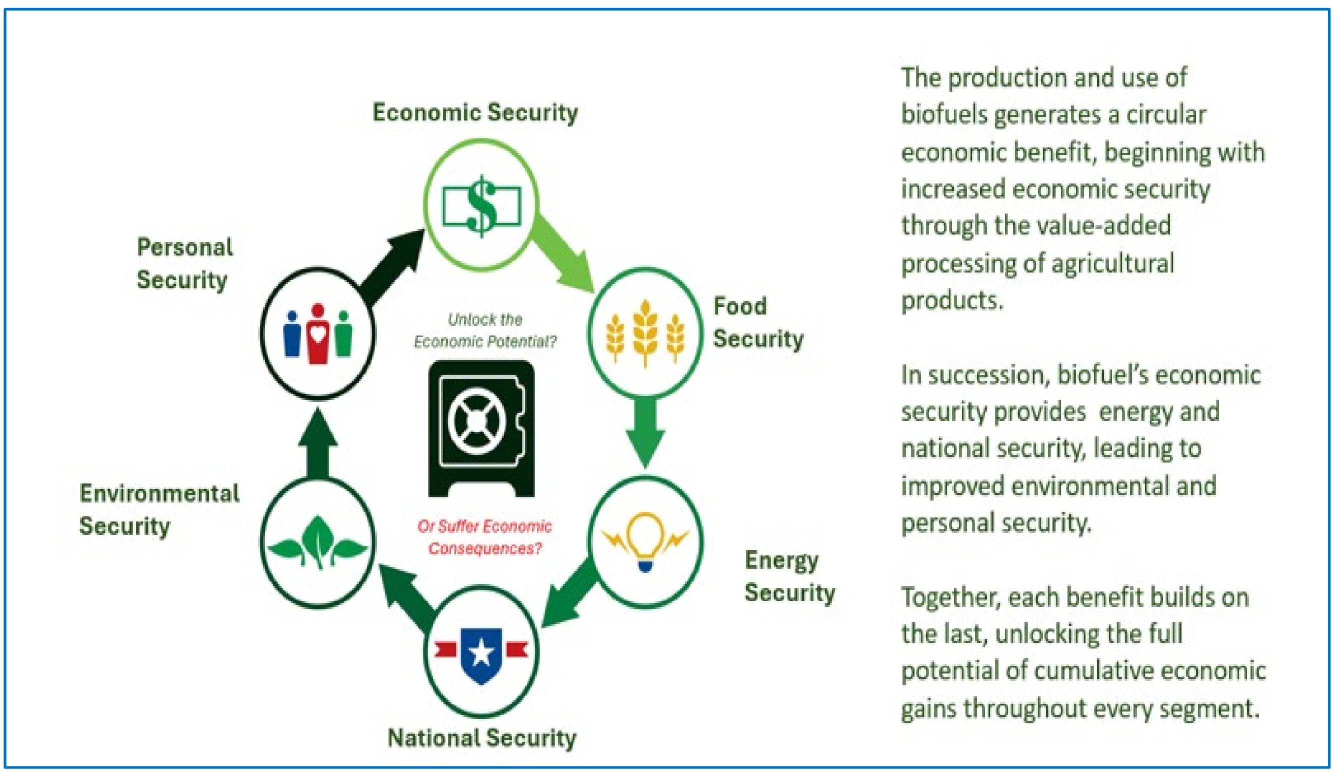
Sustainable energy demands sustainable leadership—leaders willing to look beyond narrow special interests and face the full complexity of the clean fuels Rubik's Cube. America's Agriculture and biofuel sectors were champions, benefactors, and villains during a four-decade campaign to move the nation away from leaded gasoline and its first oil embargo to new federal standards that drove new state standards.

Educating a willing public is always challenging, but changing their minds is exponentially more difficult. Research shows it can take 5 to 25 times more effort to change a choice than to sustain one, much like the difference between acquiring a new customer and keeping an existing one. History gives us proof: it took decades of relentless campaigns to change minds about smoking, to move society beyond the belief that the world was flat, and to recognize that clean air and clean fuels are essential for survival. Humans are the only species capable of changing their collective future by changing their minds—and when we do, the outcome is history itself.

The Total Societal Benefits of Biofuels

☑ A thorough total societal cost-benefit assessment of higher blends of biofuels requires evaluating the sum of their parts, with carbon reduction being just one part.

Figure 21: The Total Societal Benefits of Biofuels



Cheaper, Better, Faster, Safer Transportation Fuels

Regardless of standards, mandates, or waivers, consumers ultimately choose the pump and in the voting booth. Awareness and understanding are the levers that unlock adoption. At its core, the public education message must be simple, memorable, and consumer-focused.

Biofuels check all the boxes of the iconic “better mousetrap”: they are cheaper, better, faster, and safer than the status quo.

- ***Cheaper:*** Biofuels save consumers 20–40 cents per gallon, delivering hundreds of millions in annual household savings.
- ***Better:*** They improve air quality, strengthen farmland, and reduce reliance on imported fuels.
- ***Faster:*** They work today in existing vehicles and infrastructure, delivering immediate emission reductions while the electrification of vehicles scales.
- ***Safer:*** They enhance national and energy security by diversifying supply and reducing vulnerability to foreign disruptions and infrastructure risks.

The overall demographic appeal is straightforward:

- ☑ **Who would like more clean air, more jobs, more secure fuels, more secure farmland, less pollution, less taxes, and a safer future at a lower price?**

Framing biofuels as Cheaper, Better, Faster, and Safer makes the case in a way that is both evidence-based and values-driven, ensuring stakeholders can reach not only policymakers but also the people they serve.

Support the Development and Funding for Consumer Education and Public Education Checkoff Program

Federal and state checkoff programs for corn and soybeans are mandatory assessments that farmers pay when they sell their crops. The funds are used to collectively support industry research, consumer education, and product promotion, benefiting all producers by growing overall demand and expanding markets.

> **How Corn and Soybean Checkoff Programs Work:** Soybean Checkoff: Every soybean farmer pays a fee (typically 0.5% of the crop's market price) at the first point of sale. The collected funds are split—half remains at the state level for local investments, and half is allocated to the national United Soybean Board for broader research, promotion, and education initiatives.
>
> **Corn Checkoff:** No federal corn checkoff exists, but many states have their own. The assessment rate varies by state; state corn boards use funds for market development, research, and advocacy.

Oversight and Use: Both programs are overseen by boards made up of producer representatives. Funds cannot be used for lobbying but cover marketing ("Soy. The Smart Choice." or "Pork. The Other White Meat."), research on product/infrastructure improvements, and consumer education campaigns.

Impact: These initiatives have a robust track record of driving product innovation, market expansion, and long-term profitability for the sponsoring crop sectors.

Explanation of a Similar Checkoff for Fuel Retailers and Biofuel Producers

A comparable checkoff for fuel retailers and biofuel producers would operate by collecting a small assessment (for example, a fraction of a cent per gallon sold) whenever participating retailers or producers sell renewable biofuels (such as ethanol or biodiesel). Funds would be pooled and managed by an industry-led board.

How It Would Work: Assessment: Retailers and/or producers would pay a set fee on gallons of renewable fuel sold (e.g., $0.001 per gallon).

Fund Use:

Funds would support:

- National and local biofuel advertising/promotion campaigns to increase awareness and drive consumer demand.
- Technical research (tank compatibility, emissions, blending best practices).
- Infrastructure grants or co-funding for new dispensers, signage, and marketing at the retail level.
- Professional training for retailers and fuel distributors.
- Policy-neutral education efforts (lobbying with these dollars is generally restricted).
- Oversight: Managed by a board with representatives from fuel retailers, producers, and possibly public stakeholders, overseen by a federal or state agency (similar to USDA for ag checkoffs).

Purpose and Rationale:

Like farm commodity checkoffs, this program would equip the retail and biofuel industry to:

- Pool resources for large-scale, strategic consumer outreach.
- Co-invest in the research and infrastructure needed.
- Professionalize market growth efforts, benefiting all industry actors and expanding total demand.
- Avoid reliance on variable government grants or voluntary contributions, ensuring a sustained funding stream focused on growing the renewable fuels market.

In summary, a biofuel or fuel retailer checkoff would mirror farm checkoff programs by establishing a self-funded industry mechanism to promote, improve, and grow the marketplace for renewable fuels, thereby generating benefits distributed across all compliant participants.

Support the Establishment of the Maryland B20 Club

The B20 Club Case Studies

A club/recognition initiative specifically for public/private fleets operating consistently on B20 or higher blends — featuring technical best practices, public recognition, and peer exchange.

The B20 Club is a state-level initiative, notably active in Illinois and Indiana, that recognizes and promotes organizations operating vehicle fleets on biodiesel blends of 20% (B20) or higher. It is a partnership, such as that between the Illinois Soybean Association and the American Lung Association, designed to showcase fleets that successfully use B20 biodiesel to improve sustainability, reduce emissions, and support local agriculture.

Key Features

- The B20 Club highlights "best practice" fleets—public transit, municipal vehicles, private carriers—that commit to running on B20 or higher.
- Member fleets serve as role models for both environmental leadership and operational reliability, demonstrating how B20 can be integrated into diverse real-world operations.
- Since its founding, the Illinois B20 Club has reported more than 110 million gallons of B20 and higher blends used, delivering measurable reductions in particulate matter, hydrocarbons, and greenhouse gases.
- The initiative often brings together stakeholders to advocate for policy changes, maintain tax incentives or exemptions for using biodiesel, and educate legislators and the public on biodiesel's benefits.
- Associate members and sponsoring producers support fleet members with technical guidance and ensure fuel quality through certifications like BQ-9000.

Outcomes

- Documented health and environmental benefits such as improved air quality and reductions in healthcare costs tied to lower diesel emissions.
- Economic support for local soybean growers and biodiesel producers, strengthening the agricultural supply chain.
- Demonstrated operational success with B20 even in challenging climates and for a wide range of vehicles, building confidence for broader adoption.
- The B20 Club stands as a model for increasing biodiesel adoption at the state level, leveraging fleet leadership, robust partnerships, and public advocacy to influence policy and promote clean transportation.

- To join the B20 Club, a fleet must demonstrate a strong, ongoing commitment to running its vehicles on biodiesel blends of 20% or greater (B20) and be based in the relevant state (such as Illinois or Indiana). Membership is designed to showcase fleets that are sustainability leaders and serve as models for successful B20 integration.

Membership Requirements

- Minimum Fuel Blend: Fleets must use B20 biodiesel (20% biodiesel, 80% petroleum diesel) or higher in their routine operations.
- Consistent Use: Membership is aimed at organizations with a strong, ongoing track record of B20 or higher use—not just one-time demonstration projects.
- Commitment to Best Practices: Members are expected to follow technical best practices and may receive support to maintain fuel quality and operational performance.
- Location: Membership is typically reserved for fleets based within the state hosting the B20 Club (e.g., Illinois or Indiana).
- Openness to Sharing Experiences: Fleet members often participate in educational/outreach activities, sharing operational data and lessons learned with the broader public and other fleets.

How to Join

- Illinois B20 Club: Interested fleets should contact Bailey Arnold (American Lung Association, Director of Clean Air Initiatives) at (217) 241-9011 or Bailey.Arnold@Lung.org to begin the membership process and discuss eligibility.
- Indiana B20 Club: Fleets can reach out through the B20 Club's web portal or contact provided on the state biodiesel association's website for more information and application details.

Benefits of Membership

- Recognition as a sustainability and innovation leader.
- Access to technical support, peer networking, and industry resources.
- Opportunity to help shape policy and public opinion around biodiesel adoption.
- Featured case studies and participation in statewide promotional activities.
- Membership signals a fleet's commitment to clean fuels and its willingness to champion the operational, environmental, and economic benefits of biodiesel use.

State Agency Participation

Several state and local government fleets have joined the B20 Club, particularly in Illinois. Examples of government entities and public fleets that are B20 Club members include the Chicago Park District, Forest Preserve District of DuPage County, Lake County Division of Transportation, Naperville Park District, Wilmette Park District, CityLink (Greater Peoria Mass

Transit District), and municipal fleets such as the City of Elmhurst, City of Moline, City of Warrenville, Village of Arlington Heights, Village of Carol Stream, Village of Oak Park, and Village of Mundelein.

Section 12: Goalkeeper Scorecard

Provides the Ability to Record and Monitor the Progress of Recommendations

Purpose, Objectives, and Process

The Task Force's Goalkeeper Scorecard serves as a living, working management tool that will be updated periodically as new findings, operational insights, and challenges emerge. Designed as a dynamic framework for implementation and oversight, the Scorecard enables agencies and policymakers to track milestones, identify gaps and barriers, align budgets and legislative strategies, and report measurable progress toward CSNA and MCCC targets.

- It enables agencies and policymakers to:
- Monitor implementation milestones.
- Identify gaps and barriers.
- Align budgets and legislative strategies.
- Report measurable progress toward CSNA and MCCC targets.

The scorecard establishes a transparent system for accountability by:

- **Defining Key Metrics:** Aligning each recommendation with clear, measurable indicators such as policy adoption, funding levels, gallons of low-carbon fuels deployed, carbon reductions achieved, or stakeholder engagement milestones.
- **Track Progress Quarterly and Annually:** Documenting achievements, setbacks, and changes in real time, so the Task Force can monitor whether Maryland is moving toward its clean energy and carbon-reduction goals.
- **Highlighting Adjustments:** Capturing new developments—whether legislative, economic, or technological—that may require revisiting priorities or adapting strategies.
- **Communicating Results:** Providing policymakers, stakeholders, and the public with a straightforward way to track progress, similar to a dashboard, which fosters transparency and builds momentum.
- **Process:** Each year, Task Force staff or designated partners update the scorecard by reviewing data, agency reports, and stakeholder input. Progress for each recommendation is rated (e.g., using a traffic-light or scoring system) to indicate whether the state is on track, lagging, or requiring *attention*. This allows the Task Force to celebrate successes, identify barriers, and recommend course corrections in subsequent annual reports.

Summary

Maryland is positioned to accelerate progress toward its Climate Solutions Now Act (CSNA) goals by implementing a coordinated, cross-agency strategy to expand the production, distribution, and use of low-carbon biofuels. The Goalkeeper Scorecard consolidates recommendations from the Maryland Biofuels Task Force to provide a clear roadmap for statewide implementation, accountability, and performance tracking.

Key Objectives

1. **Adopt a Clean Fuel Standard (CFS)** aligned with Maryland Commission on Climate Change (MCCC) guidance to reduce carbon intensity, strengthen energy security, and generate an estimated **$500–$750 million in annual consumer fuel savings**.
2. **Increase statewide availability and adoption of cleaner fuels**, including E10/E15 ethanol blends and B10/B20 biodiesel blends, across state, transit, and commercial fleets.
3. **Improve fuel quality, transparency, and public trust** through enhanced labeling, BTEX/aromatics disclosure, and regular laboratory fuel testing.
4. **Expand infrastructure** for ethanol and biodiesel through grants, low-interest loans, and targeted investments guided by state fleet fueling data.
5. **Support in-state production and innovation**, including advanced biofuels, Climate-Smart Agriculture, and feedstock development supported by 45Z tax credits.
6. **Elevate statewide consumer awareness** through education campaigns, the Maryland Biofuels Information Center, and integration of biofuel knowledge into driver's education and public health messaging.

Cross-Agency Responsibilities

The Scorecard assigns recommended actions across major state agencies to ensure coordinated implementation:

1. **Governor's Office/General Assembly:** Establish statutory authority and executive direction for a CFS, blend standards, and cross-agency coordination.
2. **MDE:** Lead rulemaking, permitting efficiencies, VEIP integration, and air quality monitoring.
3. **MDA:** Support feedstock development, labeling, retailer engagement, and public education.
4. **MEA:** Provide infrastructure grants and lead economic education initiatives.
5. **MDOT & MVA:** Modernize fleet procurement, install fueling infrastructure, and integrate biofuel education into licensing and safety campaigns.
6. **Comptroller/DBM/DGS:** Strengthen procurement policies, fuel quality enforcement, and adoption of biobased products.
7. **Commerce:** Support financing mechanisms, revolving funds, and production facility development.

8. **MDH:** Integrate public health research, messaging, and exposure monitoring for BTEX and related pollutants.

Strategic Impact & Outcomes

Implementing these recommendations will:

1. Significantly reduces the carbon intensity of Maryland's transportation and heating fuels.
2. Provide immediate and affordable decarbonization options parallel to long-term electrification goals.
3. Deliver measurable health benefits by reducing exposure to harmful aromatics and BTEX compounds.
4. Strengthen Maryland's agricultural and economic resilience through local feedstock and fuel production.
5. Establish Maryland as a regional leader in clean fuel deployment, innovation, and consumer education.

Table 72: MDBTF Goalkeeper Scorecard

Agency / Office	Recommendation	Action Taken
Governor's Office / General Assembly	Issue Executive Orders and/or enact statutes to adopt a Clean Fuel Standard aligned with MCCC Mitigation Working Group guidance.	
Governor's Office / General Assembly	Coordinate cross-agency collaboration for CFS implementation and public service announcements.	
Governor's Office / General Assembly	Provide resources for research and the implementation of statewide biofuel programs.	
Governor's Office / General Assembly	Support statewide blend requirements for ethanol (E10/E15) and biodiesel (B10/B20).	
Maryland Department of Agriculture (MDA)	Launch and manage the Maryland Biofuels Information Center.	
MDA	Collaborate on Fuel Retailer Engagement Survey with Weights & Measures.	
MDA	Establish and enforce labeling for blend level, country of origin, aromatics, and BTEX content.	
MDA	Conduct regular laboratory testing for octane and BTEX.	
MDA	Update the Priority Investment List for dispensers and USTs compatible with higher blends.	
MDA	Provide R&D grants for feedstock innovation (algae, waste oils, non-edible crops).	
MDA	Support and help implement the 45Z Climate-Smart Clean Fuel Producer Tax Credit.	
MDA	Study the feasibility of a "biofuels check-off" program for retailers and producers.	
MDA	Support and expand participation in a Maryland B20 Club.	

Maryland Department of the Environment (MDE)	Lead rulemaking for the Clean Fuel Standard and Clean Heat Standard.	
MDE	Conduct street-level air quality monitoring, including aromatics/BTEX tracking.	
MDE	Accelerate environmental permitting for infrastructure upgrades, production facilities, and fueling sites.	
MDE	Support VEIP integration of FFV identification and consumer education.	
MDE	Make biofuels eligible for incentives currently targeted to EV programs for hard-to-decarbonize sectors.	
MDE	Participate in public engagement and statewide PSA campaigns.	
MDE	Support and expand B20 Club recognition.	
Maryland Department of Health (MDH)	Provide public health information on emissions, BTEX exposure, and the benefits of reduced aromatics via biofuel use.	
MDH	Conduct BTEX blood testing for high-exposure occupations (garage attendants, drive-thru workers, highway corridor workers).	
MDH	Collaborate on cross-agency PSA campaigns linked to emissions and health.	
Maryland Department of Energy (MEA)	Administer grants and incentives for E15/E85, B20/B100, and terminal/depot infrastructure upgrades.	
MEA	Develop and run public education campaigns about fuel competition and the economics of supply/demand.	
MEA	Support and expand B20 Club recognition.	
Maryland Comptroller / DBM / DGS / Field Enforcement	Study and implement biofuel purchasing requirements for state fleets, transit, and state facilities.	
Comptroller – Field Enforcement	Enforce fuel dispenser labeling for blend level, biofuels content, aromatics, BTEX reductions, and volumetric disclosure.	
Comptroller – Field Enforcement	Conduct laboratory testing of retail fuels (octane, oxygenates, contaminants).	
DBM Fleet & Travel	Collaborate on a statewide Fleet Administrator Survey to expand B20/E15 adoption.	
DGS / Procurement	Expand procurement of biobased products and biofuel-based products.	
Maryland Department of Transportation (MDOT)	Use state fuel card data to identify strategic locations for new biofuel infrastructure.	
MDOT	Prioritize procurement of biofuel-compatible vehicles.	
MDOT	Install or upgrade biofuel infrastructure at rest stops, depots, and maintenance facilities.	
MDOT	Participate in pilot programs and demonstration fleets, including the B20 Club.	
MDOT	Lead transportation-related public awareness campaigns on biofuels.	
Maryland Motor Vehicle Administration (MVA)	Incorporate FFV identification and biofuel education into inspections and registration.	

MVA	Add sections on biofuels, emissions, and energy security to the driver education curriculum.	
MVA	Include biofuel-related questions in driver's license testing.	
MVA	Coordinate "safety-style messaging" campaigns promoting biofuel benefits.	
Department of General Services (DGS)	Adopt procurement requirements for biobased and biofuel-based products.	
Maryland Department of Commerce	Support revolving funds and financial incentives for biofuel production and infrastructure development.	
Other Recommendations for Consideration	Adopt a statewide Clean Fuel Standard modeled after California's year-round E15 authorization.	
Other Recommendations for Consideration	Establish statewide ethanol (E10/E15) and biodiesel (B10/B20) minimum blend standards.	
Other Recommendations for Consideration	Expand fueling infrastructure via grants, low-interest loans, and revolving funds.	
Other Recommendations for Consideration	Support the development of ethanol and biodiesel production facilities through incentives and permitting.	
Other Recommendations for Consideration	Invest in advanced biofuels R&D and climate-smart feedstocks.	
Other Recommendations for Consideration	Strengthen supply chain partnerships and explore checkoff funding mechanisms.	

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