

TLU-4 Low Greenhouse Gas Fuel Standard

Policy Description

A low greenhouse gas fuel standard (LGFS) would create a market-based program to reduce the GHG emissions from transport fuels and diversify transport fuel options for consumers.

The LGFS is not designed to be biased toward any particular fuel: it would include fossil and renewable fuels. Instead, the LGFS is designed to require fuel providers to reduce the greenhouse gas (GHG) intensity of the fuels they sell in Maryland. “Fuel providers” are identified as producers, importers, refiners, and blenders.

The LGFS is not a tailpipe standard for GHGs. The LGFS considers GHG emissions on a full fuel cycle basis, which includes not only tailpipe emissions, but also emissions associated with the production and distribution of fuels (Well to Wheels). This will result in varying carbon impact values for fuels that would otherwise look the same to customers.¹ The extent of GHG emission reduction will be greater if regional implementation can be coordinated.

Policy Design

Goals: Implement policy that reduces the average carbon intensity of on-road transportation fuel 10 % by 2020.

Timing: TBD

Parties Involved: All layers of government, fuel providers

Implementation Mechanisms

1. Partnership with the Department of Transportation to create the framework for the LCFS.
2. Market-based mechanisms for fuel providers to choose how they wish to meet LGFS.
3. Full life cycle basis of measuring GHG impact of transportation fuels. Implemented by a cap and trade system for fuel providers.
4. Financial incentives for refueling station creation and retrofitting based on LGFS.
5. Certification process
6. To the extent practicable, harmonize with CA Low Carbon Fuel Standard (LCFS)

Related Policies/Programs in Place

Maryland requires that at least 50 percent of State vehicles must use a minimum biodiesel blend of B5 beginning in fiscal year 2008.

¹ For example, how ethanol is made affects its life-cycle GHG profile substantially.

Types(s) of GHG Reductions

All GHG types in the fuel life cycle.

Estimated GHG Reductions and Net Costs or Cost Savings

	MMt CO ₂ e		
	2005	2015	2020
No action-trend (Light-duty + heavy-duty)	23.94 + 5.89 = 29.83	26.97 + 7.91 = 34.88	28.78 + 9.18 = 37.96
CA LCFS – 10% by 2020			34.16
Reduction			3.8

Under the LCFS, fuel providers would be required to track the global warming intensity (GWI) of their products, measured on a per-unit-energy basis, and reduce this value over time. Global warming intensity is a measure of all of the mechanisms that affect global climate including not only GHGs, but also processes (like land use changes that may result from biofuel production). The term life cycle refers to all of the activities included in the production, transport, and storage and use of fuel. The unit of measure for GWI used in this study is CO₂e per mega joule of fuel delivered to the vehicle (g CO₂e/MJ) and adjusted for inherent differences in the in-use efficiency of different fuels (e.g., diesel, electricity, and hydrogen).

The table below summarizes the light-duty vehicle scenarios that were evaluated in the CA low carbon fuel standard study. This table compares the baseline scenario of continuing use of existing fuel and vehicle technologies with various fuel and vehicle innovations. While the LCFS could be met, in part, by vehicle technology innovations, it is suggested that the scenarios of most interest to MD should be the two labeled: (1) existing vehicles with advanced biofuels, and (2) biofuel intensive. For these two scenarios, D10 and G10 represent the 10 percent reduction goal.

The D10 scenario includes two types of advanced biofuels for light-duty vehicles, low GHG biofuel blends with gasoline and low GHG Fischer-Tropsch (FT) diesel blends. This scenario minimizes changes to the fuel delivery infrastructure, including the equipment to ship biofuels into and within the State and at retail stations. This scenario avoids the use of E85. Attaining a 10 percent AFCI reduction by 2020 requires some biofuels with performance better than the identified low GHG fuels (cellulosic ethanol from switch grass or Midwest prairie grass). Unfortunately, these are controversial, and it is not clear that such fuels are technically feasible. An alternative is to increase the fraction of biofuel blended with gasoline.

The G10 scenario is designed to explore potential outcomes that require as little fuel and vehicle innovation as possible, and instead rely mostly on large volumes of mid-GHG biofuels in both low blends (10 percent by volume in gasoline and 10 percent bio/renewable diesel) and high blends (85 percent volume in gasoline).

Light-duty Vehicle Scenario Names, Descriptions, and AFCI Goals

Scenario Name	Fuel Innovations	Vehicle Innovations	AFCI Goals		
			-5%	-10%	-15%
Baseline	Current technologies	Gasoline ICE dominates Increased diesel, HEVs	A*		
Electric Drive	Electric charging & H2 refueling	Significant innovation in PHEV, EV, and FCV technologies	C5	**	**
Existing Vehicles with Advanced Biofuels	Significant biofuel innovation Low-GHG biofuels (5.7% vol.) Low-GHG FT diesel blends	None required	D5	D10	**
Evolving Biofuels and Advanced Batteries	No fuel innovation Mid-GHG biofuels (10% vol.) Mid-GHG biodiesel blends	Advances in PHEV, EV, and FCV technologies.	F5	F10	**
Biofuel Intensive	No fuel innovation Mid-GHG biofuels (10%, 85%) Mid-GHG biodiesel blends Low-GHG fuels for G15	None required	G5	G10	G15
Multiple Fuels & Vehicles	Low-GHG biofuels (10%, /85%) Low-GHG FT diesel blends Electric charging & H2 refueling	Advances in PHEV, EV, and FCV technologies	H5	H10	H15
Heavy Duty Compliance	(to be determined)	(to be determined)			

NOTES: *No AFCI goal applies; **Not considered.

No "B" or "E" scenarios are used to avoid confusion with biodiesel and ethanol blends.

In the "No fuel innovation" scenarios, investment is needed to increase the use of current technologies, but no new technologies are assumed. Biofuel scenarios that assume energy crop production for mid-GHG ethanol (F and G scenarios) have large uncertainties due to feedstock production. See Section 2.4.

The incremental cost of biodiesel is 20 cents per gallon above the cost of petroleum diesel. MD 2020 on-road diesel usage is expected to be 837 million gallons. If 20 percent of the petroleum diesel gallons are replaced with biodiesel, then the added consumer cost in MD during 2020 is \$33.5 million. Diesel CO₂ emission reductions in a 10 percent reduction scenario are 0.998 million metric tons. The cost effectiveness of these diesel emission reductions are \$33.5 dollars per metric ton CO₂e.

Based on 2007 U.S. prices, the cost per gallon for gasoline is \$3.03 per gallon while the cost for ethanol as E85 is \$3.71 (to get the energy equivalent of a gallon of gasoline). The gasoline cost analysis reviewed the 2020 gallons of gasoline equivalent projections of light-duty vehicle fuel use by fuel type for the D10 and G10 scenarios in California. The G10 scenario was ultimately used for this cost analysis because it included the largest penetration of E85. The CA analysis showed a 14 percent statewide reduction in gasoline usage, with most of these gallons replaced with either E85 or an ethanol blend. A 14 percent reduction in 2020 gasoline gallons in MD is 376 million gallons. The cost of achieving this gasoline displacement is \$255 million at a 68 cent price differential per gallon. A 10 percent reduction in gasoline-associated carbon is estimated to yield a 2.878 million metric ton reduction in CO₂e. The associated cost effectiveness is \$88.6 per metric ton.

- **Data Sources:** Based on the University of California report on a low carbon fuel standard for California.
- **Quantification Methods:** [e.g., Full life-cycle analysis with supply/demand equilibrium adjustments on TWG approval]

- **Key Assumptions:** [TBD, as needed on TWG approval]

Key Uncertainties

There is considerable uncertainty in the future price of gasoline and petroleum diesel as well as the lower carbon alternatives to these transportation fuels.

Additional Benefits and Costs

TBD – [as needed and approved by the TWGs]

Feasibility Issues

TBD – [as needed and approved by the TWGs]

Status of Group Approval

Pending – [until MWG moves to final agreement at meeting #5 or #6]

Level of Group Support

TBD – [blank until MWG meeting #5]

Barriers to Consensus

TBD – [blank until final vote by the MWG]

TLU-10 Off-Road Engines/Vehicles

Policy Description

This option addresses marine, rail and other off-road engine and vehicles such as construction equipment.

Policy Design

Goals:

To reduce emissions from off-road engines/vehicles by 15% by 2020 by implementing the following:

1. Provide incentives to increase purchases of fuel-efficient or low GHG vehicles.
2. Increase the use of alternate fuels or low sulfur diesel to reduce GHG emissions.
3. Reduce idling time in locomotive and construction equipment.
4. Initiate marketing and education campaigns to operators of off-road vehicles.
5. Adopt “Green Port Strategy” for Baltimore area port facilities

- **Timing:**

- **Parties Involved:**

- **Other:**

Implementation Mechanisms

Details for implementing policies include:

1. Provide incentives to increase purchases of fuel-efficient or low GHG vehicles.
 - a. Examples of vehicles targeted by program include pure electric, hybrid, plug-in hybrid, and other alternative fuel vehicles
 - b. Examples of incentives include
 - i. Fees on relatively high emissions/lower fuel economy vehicles.
 1. That is, higher vehicle registration fees can be charged for vehicles that have lower fuel economy, and/or vehicles that use alternative fuels could be charged a lower vehicle registration fee.
 2. Vehicle licensing fees could be based upon vehicle weight, with use of a dollar per vehicle-ton multiplier instead of the present broad categories of vehicle weight.

- ii. Rebates or tax credits on low emissions/higher fuel economy vehicles.
 - iii. Implement a sliding scale tax that would allow purchasers of low greenhouse gas emitting vehicles to earn a rebate on their vehicle registration or sales tax of up to X%, and purchasers of high greenhouse gas emitting vehicles to be assessed a vehicle registration or additional sales tax of up to X%. The sliding scale could be designed to be revenue-neutral, i.e., such that rebates are offset by fees assessed.
- 2. Increase the use of alternate fuels or low sulfur diesel to reduce GHG emissions. By increasing the availability and usage of alternative fuels (low carbon fuel) and low sulfur diesel for off-road vehicles, as well as recreational marine usage, there could be a significant reduction in GHG emissions.
- 3. Reduce idling time in locomotive and construction equipment.
 - c. Consider increasing measures to reduce locomotive idling including “auxiliary engines” to help maintain power, as well as “plug in” power receptacles in the proposed train storage yards.
 - d. For equipment in construction contracts, there would be clauses that would restrict idling time in construction equipment.
- 4. Initiate marketing and education campaigns to operators of off-road vehicles.
 - e. Providing the operators of off-road vehicles with better operations information and education can lead to a gain in fuel efficiency.
 - f. Operators also need to be aware of maintenance issues that cause an increase in pollution and vehicle operating cost. By ensuring vehicles are well maintained, fuel efficiency and emissions benefits can be achieved.
- 5. Adopt “Green Port Strategy” for Baltimore area port facilities
 - g. Introduce less polluting, more energy efficient technologies for vessel dwelling and for land-side cargo handling equipment as part of strategy
 - h. Include providing “shore power” at the port sites where applicable and feasible for shipping vessels.
 - i. Replace diesel cranes at the Port; consider electrifying, or other methods to reduce GHG emissions, if feasible.

Related Policies/Programs in Place

CMAQ funding can be used for retrofits that reduce idling and associated energy use.

Types(s) of GHG Reductions

TBD – [CCS should provide a worksheet and other reference material as needed for transparency]

Estimated GHG Reductions and Net Costs or Cost Savings

TBD – The table below summarizes transportation sector off road engine/vehicles baseline CO₂e emissions compared with a 15% by 2020 reduction program.

Transportation Sector Off Road Engines/Vehicles

	MMt CO ₂ e		
	2005	2015	2020
No action-trend (marine, air, rail, other)	2.69	2.81	2.95
GHG reduction strategy			2.51
Reduction			0.44

This option includes a mix of policies designed to reduce GHG emissions from off-road engines/vehicles. The costs and benefits of each of the individual policies are different.

For example, options like locomotive auxiliary engines and providing shore power at port facilities typically have a cost-effectiveness of zero or a cost savings. However, pursuing these options requires an upfront capital investment to purchase a more efficient engine, and the cost savings results from reduced fuel usage compared with the original equipment. Payback periods for this capital investment typically range from 1 to 5 years.

Costs of alternative fuels strategies for off-road equipment would be expected to be similar to those shown under the cost analysis for TLU-4.

- **Data Sources:** [TBD by CCS on TWG approval]
- **Quantification Methods:** [e.g., Full life-cycle analysis with supply/demand equilibrium adjustments on TWG approval]
- **Key Assumptions:** [TBD, as needed on TWG approval]

Key Uncertainties

TBD – [as needed and approved by the TWGs]

Additional Benefits and Costs

TBD – [as needed and approved by the TWGs]

Feasibility Issues

TBD – [as needed and approved by the TWGs]

Status of Group Approval

Pending – [until MWG moves to final agreement at meeting #5 or #6]

Level of Group Support

TBD – [blank until MWG meeting #5]

Barriers to Consensus

TBD – [blank until final vote by the MWG]