

The Contribution of Advanced Renewable Transport Fuels to **Transport Decarbonisation** in 2030 and beyond



U.S. DEPARTMENT OF
ENERGY

Energy Efficiency &
Renewable Energy

The Role of Renewable Transport Fuels in the United States

IEA Transport Decarbonisation Workshop

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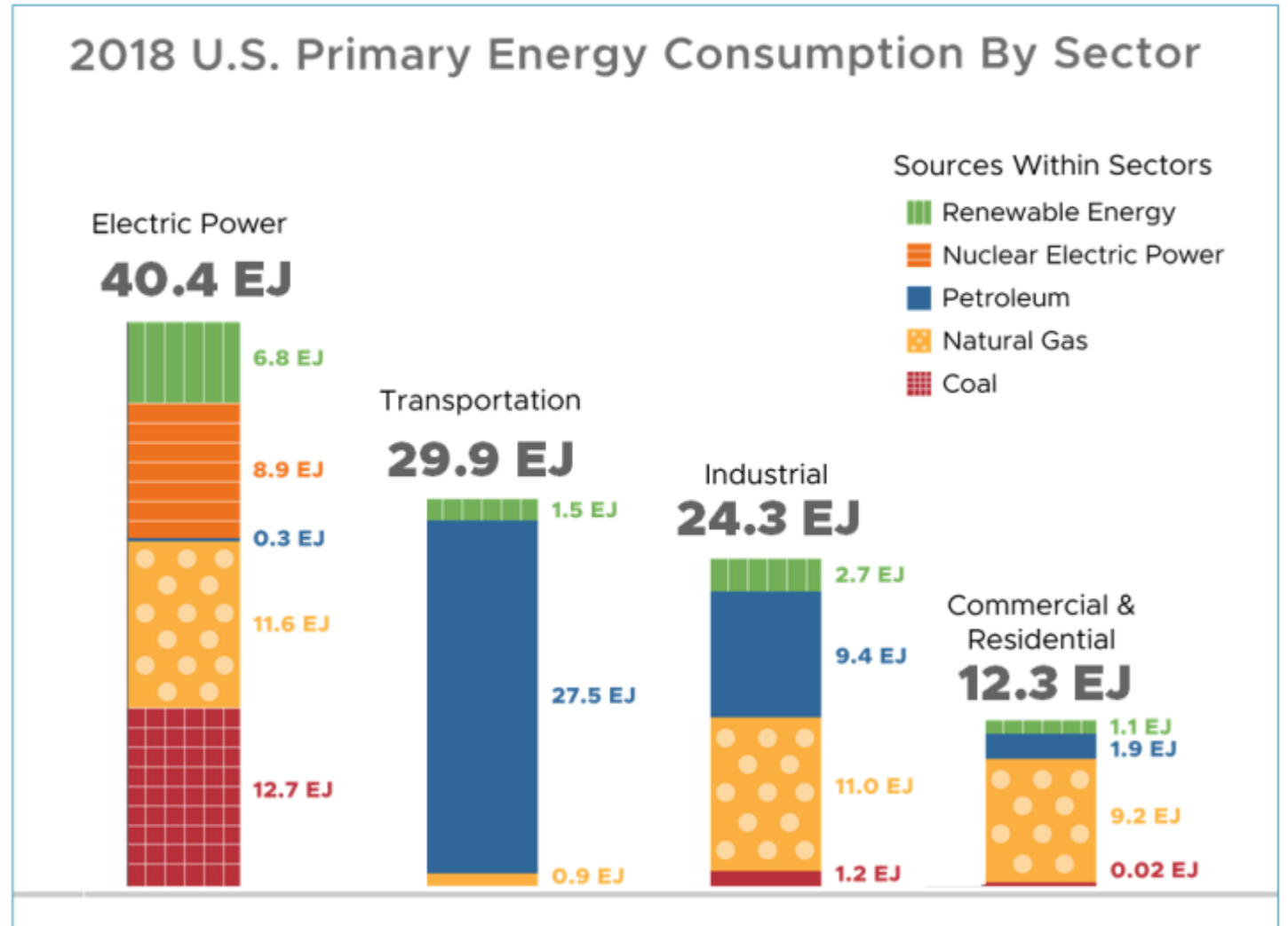
U.S. Department of Energy

Snapshot of U.S. Energy Use by Sector and Source

The U.S. uses 107 EJ* of primary energy each year

- Coal, 14 EJ
- Natural gas, 33 EJ
- Petroleum, 39 EJ
- Nuclear, 9 EJ
- Renewables, 12 EJ

*1 EJ is equal to 948.45 tBtu



Source: [U.S. Energy Information Administration, Monthly Energy Review, July 2019](#)

Transportation Uses 28% of Nation's Energy



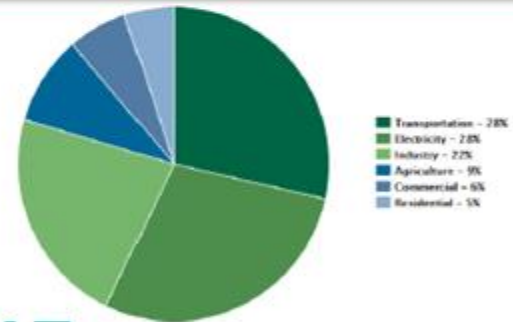
Every year, we transport **11** billion tons of goods and travel **3** trillion vehicle-miles.



69% of petroleum used for transportation.
86% of it used for on-road vehicles.



Transportation is the **2nd** largest expense for U.S. households.

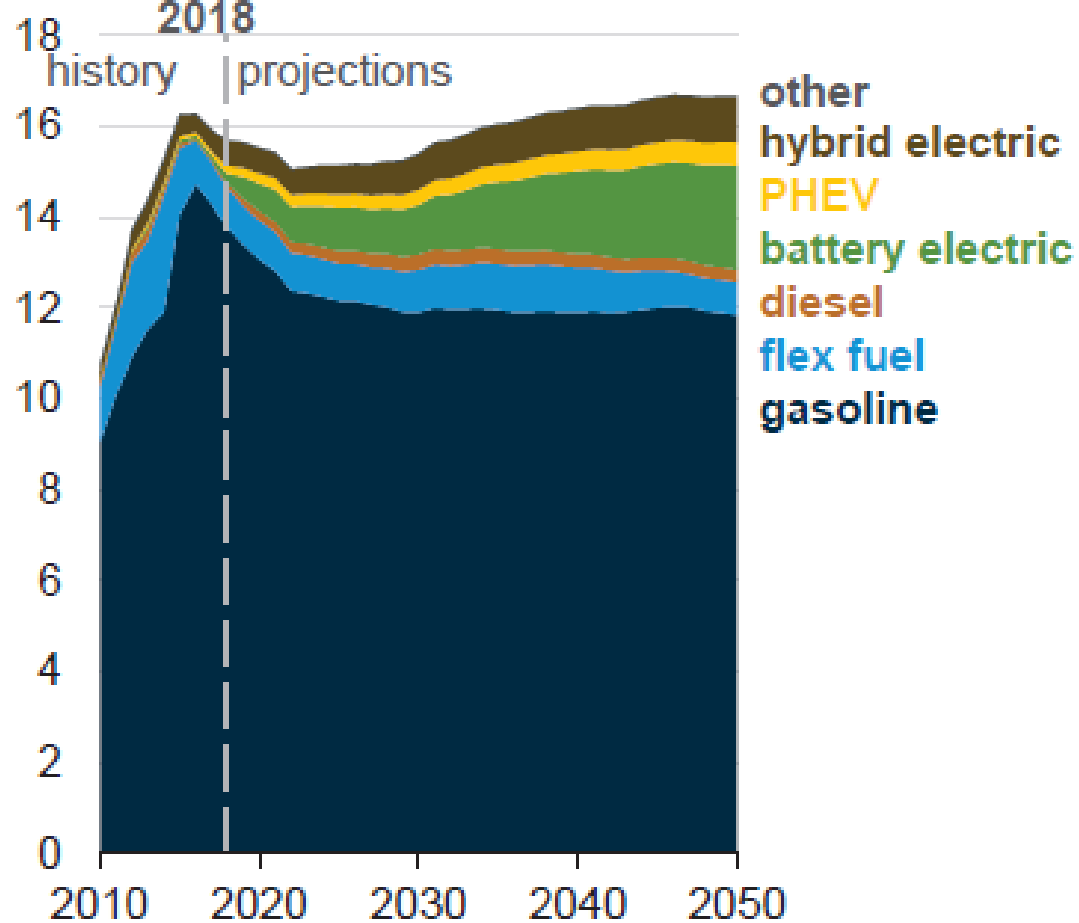


In **2017**, transportation accounted for **29%** of total U.S. greenhouse gas emissions.

Liquid Fuels will Remain Important for Transportation

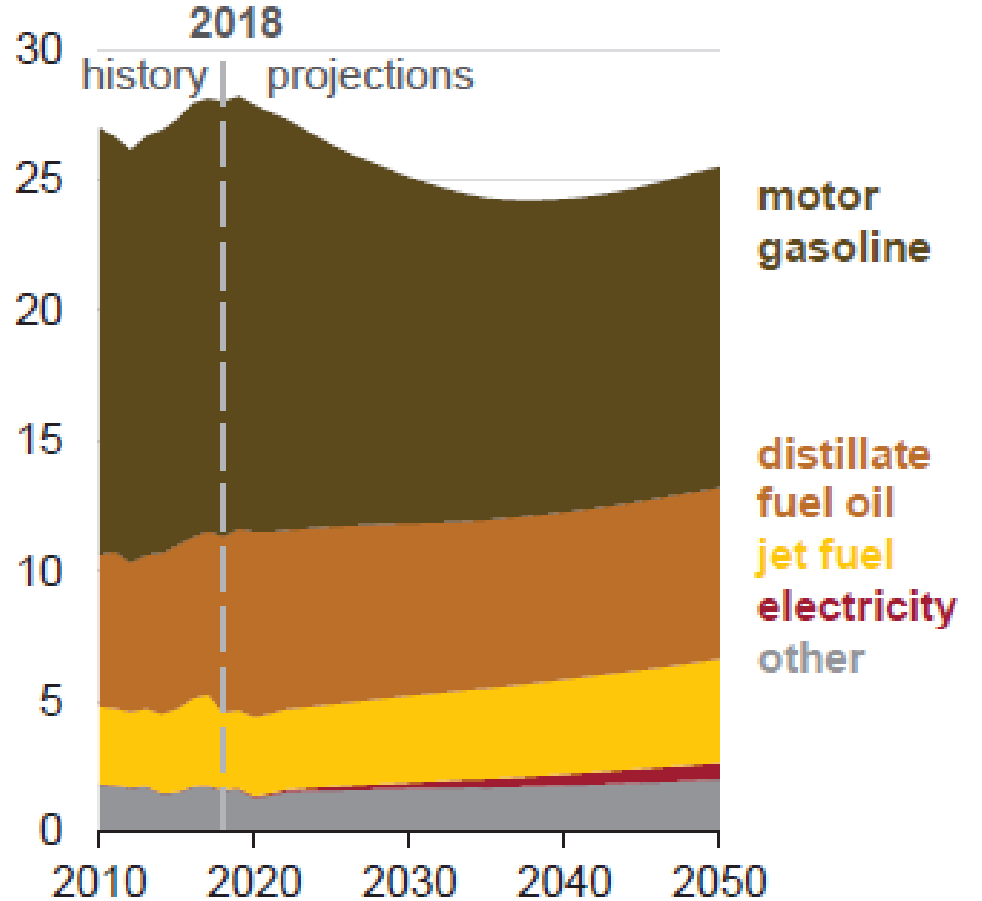
Light-duty vehicle sales by fuel type (Reference case)

millions of vehicles



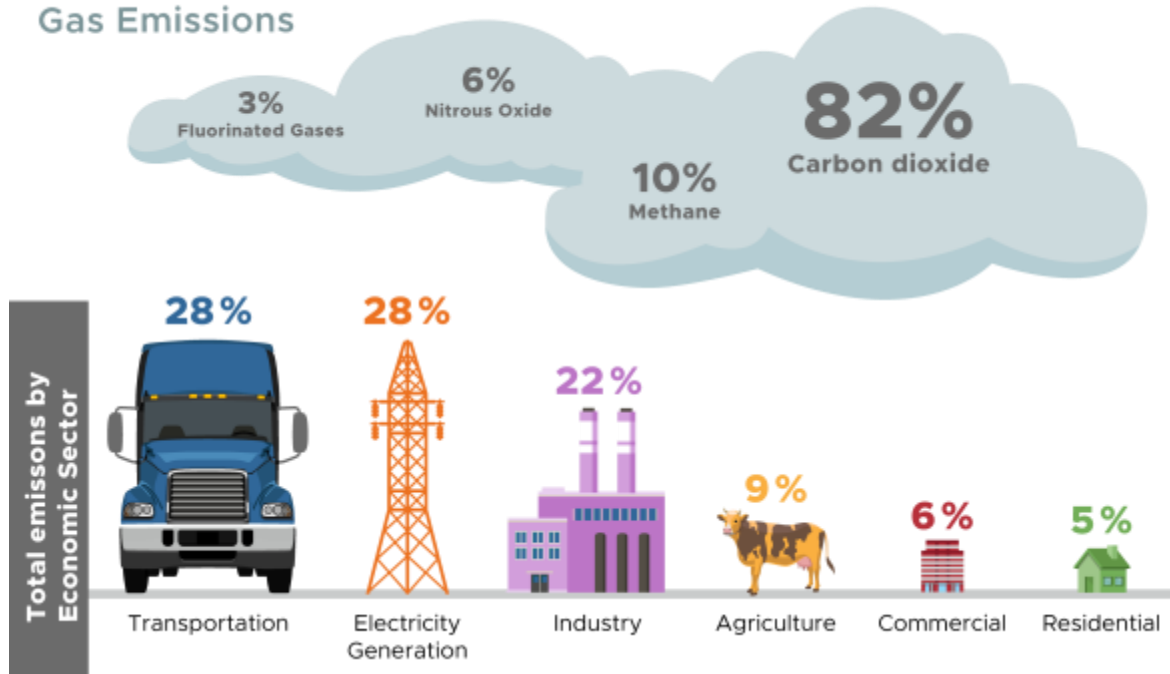
Transportation sector consumption (by fuel) (Reference case)

quadrillion British thermal units

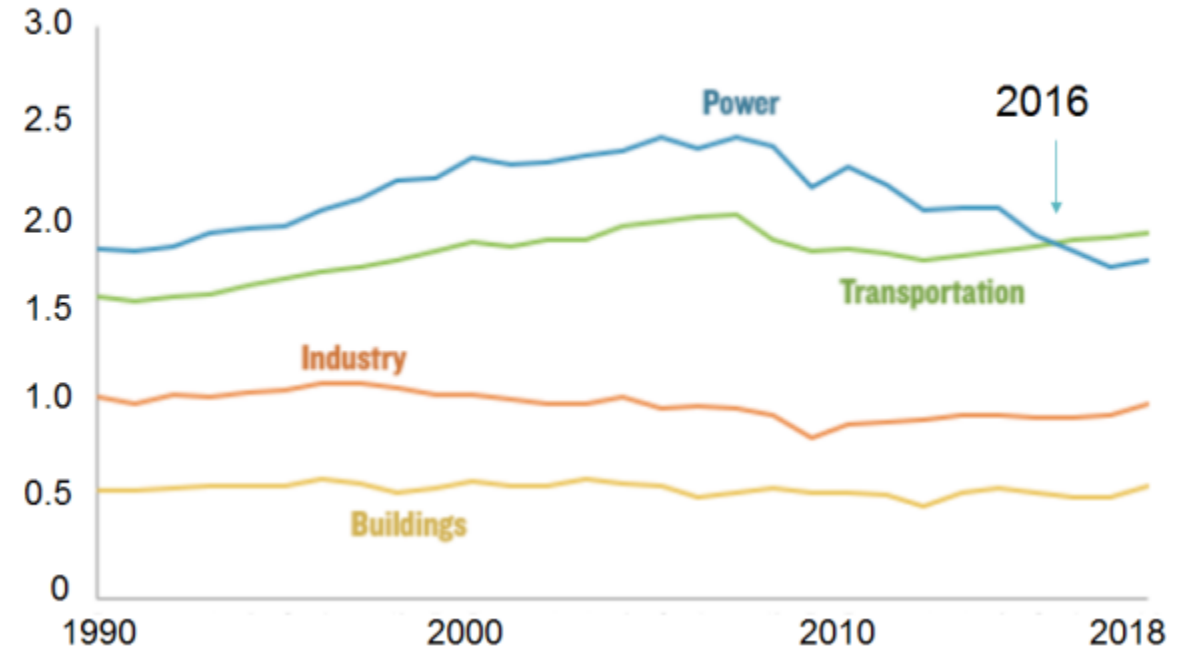


U.S. GHG Emissions

2016 U.S. Greenhouse Gas Emissions



Energy Related CO₂ Emissions by Sector, (Pg)



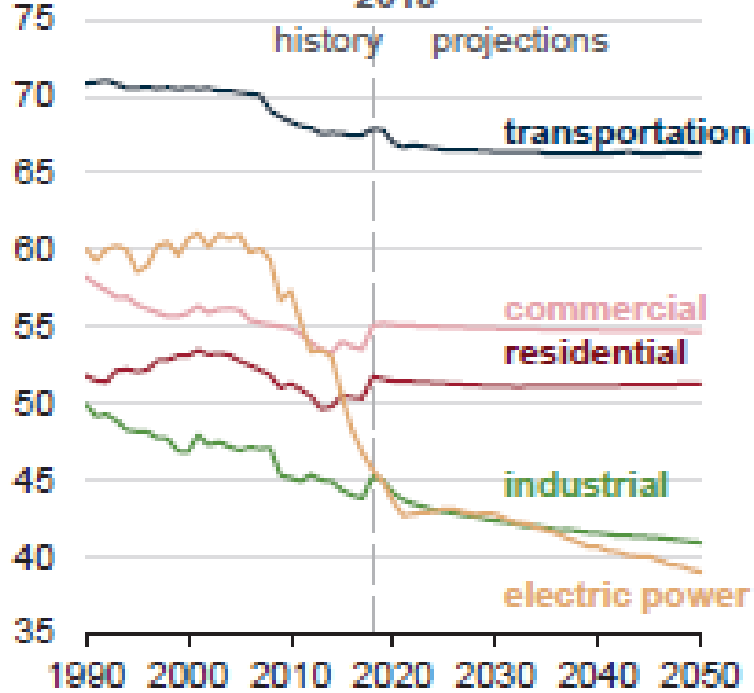
Energy related CO₂ emissions from 1990 to 2018

Source: [Rhodium Group](#)

CO₂ Intensity is Projected to Decrease due to Fuel Mix Changes

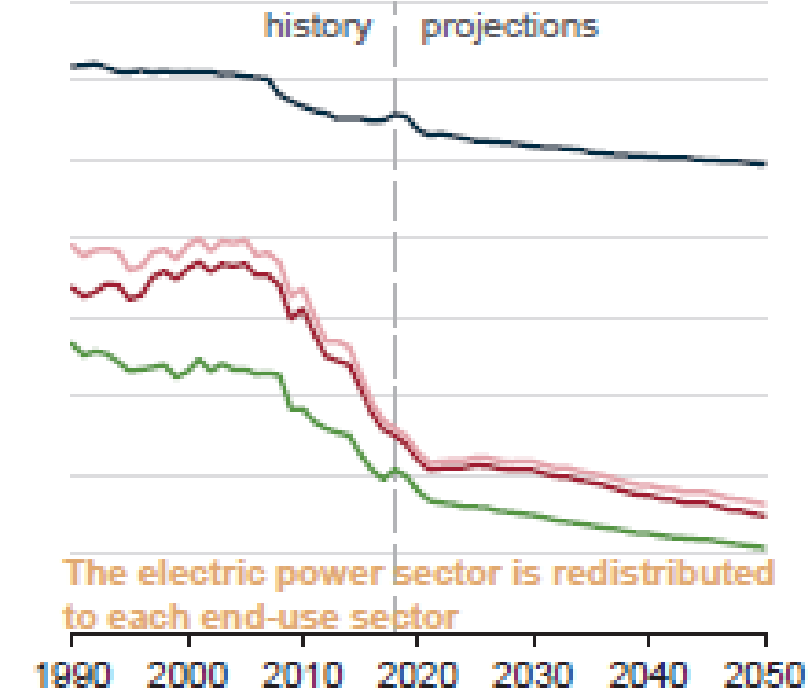
Carbon dioxide intensity by end-use sector
(Reference case)

metric tons of carbon dioxide per billion British thermal units



Carbon dioxide intensity by end-use sector
(Reference case)

metric tons of carbon dioxide per billion British thermal units



The transportation sector is projected to maintain the highest CO₂ intensity

Note: Carbon dioxide intensities are calculated as carbon dioxide emissions per unit energy output (in British thermal units).

Source: [EIA 2019 Annual Energy Outlook](#)

Current Use of Biofuels (2018)

U.S. fuel production by type	Million Gallons	%
Renewable fuel (-20% GHG)	14,955	86%
Ethanol (corn)	14,955	
Advanced (-50% GHG)	2,212	12.5%
Biodiesel	1,855	
Renewable diesel	305	
Other	52	
Cellulosic (-60% GHG)	275	1.5%
Ethanol	6.5	
Renewable natural gas (LNG/CNG)	268	
Other	0.5	

U.S. biofuels provide 5% of total fuel demand

97% of biofuels are produced from starch or vegetable oil

~3% of biofuels are produced from waste C (animal fat or landfill gas)

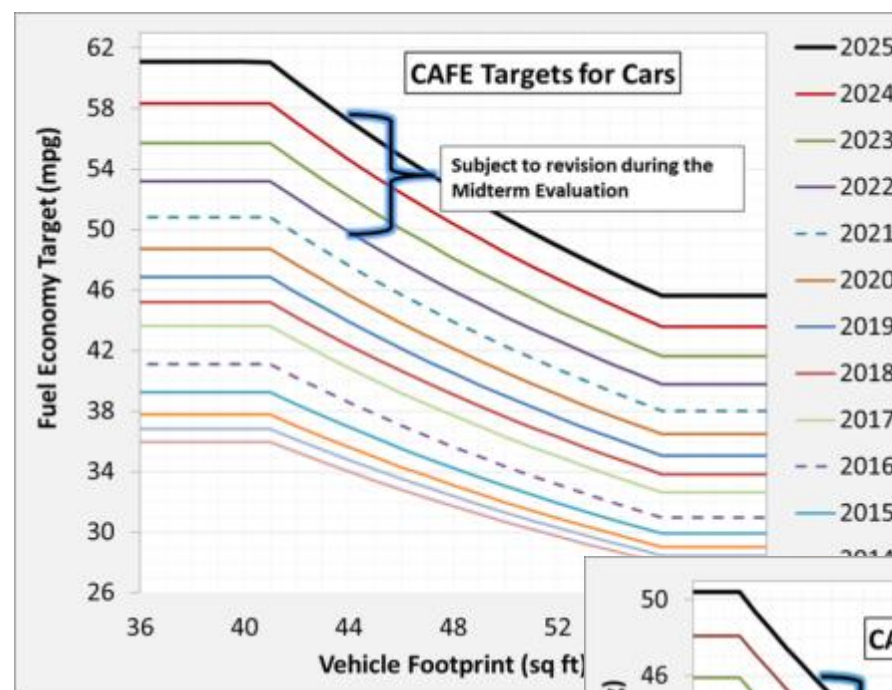
~0.04% cellulosic ethanol

Source: [EPA](#) RIN production data

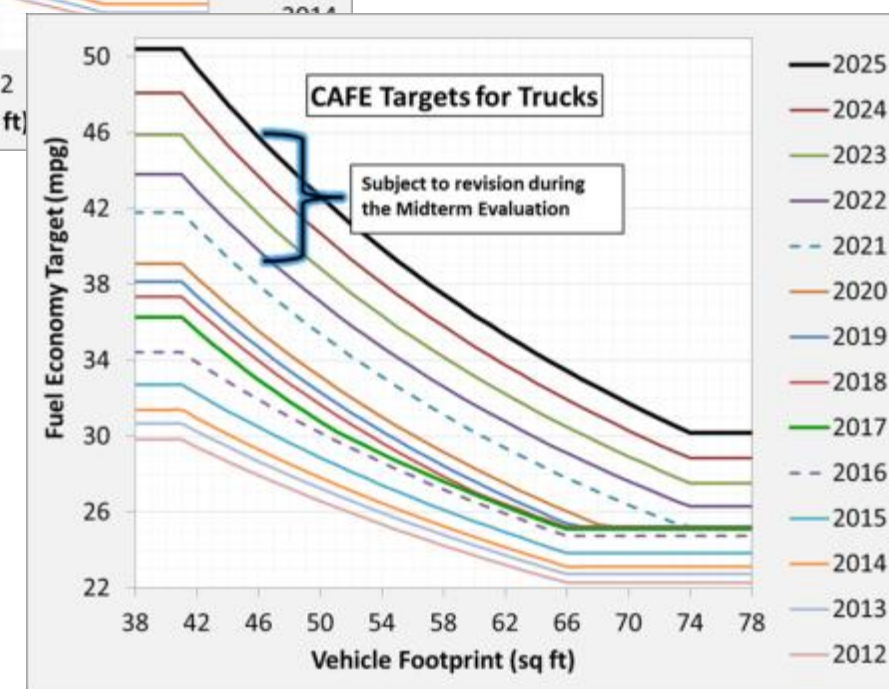
Federal Policies for GHG Emission Reduction in Road-Transportation Sector

Corporate Average Fuel Economy (CAFE) Standards

- Regularly increase the fuel economy required by automakers
- Cars and light trucks of model year 2017-2021
 - 40.3-41 mpg on average
 - 163 grams/mile of CO₂



Source: [NHSTA](#)

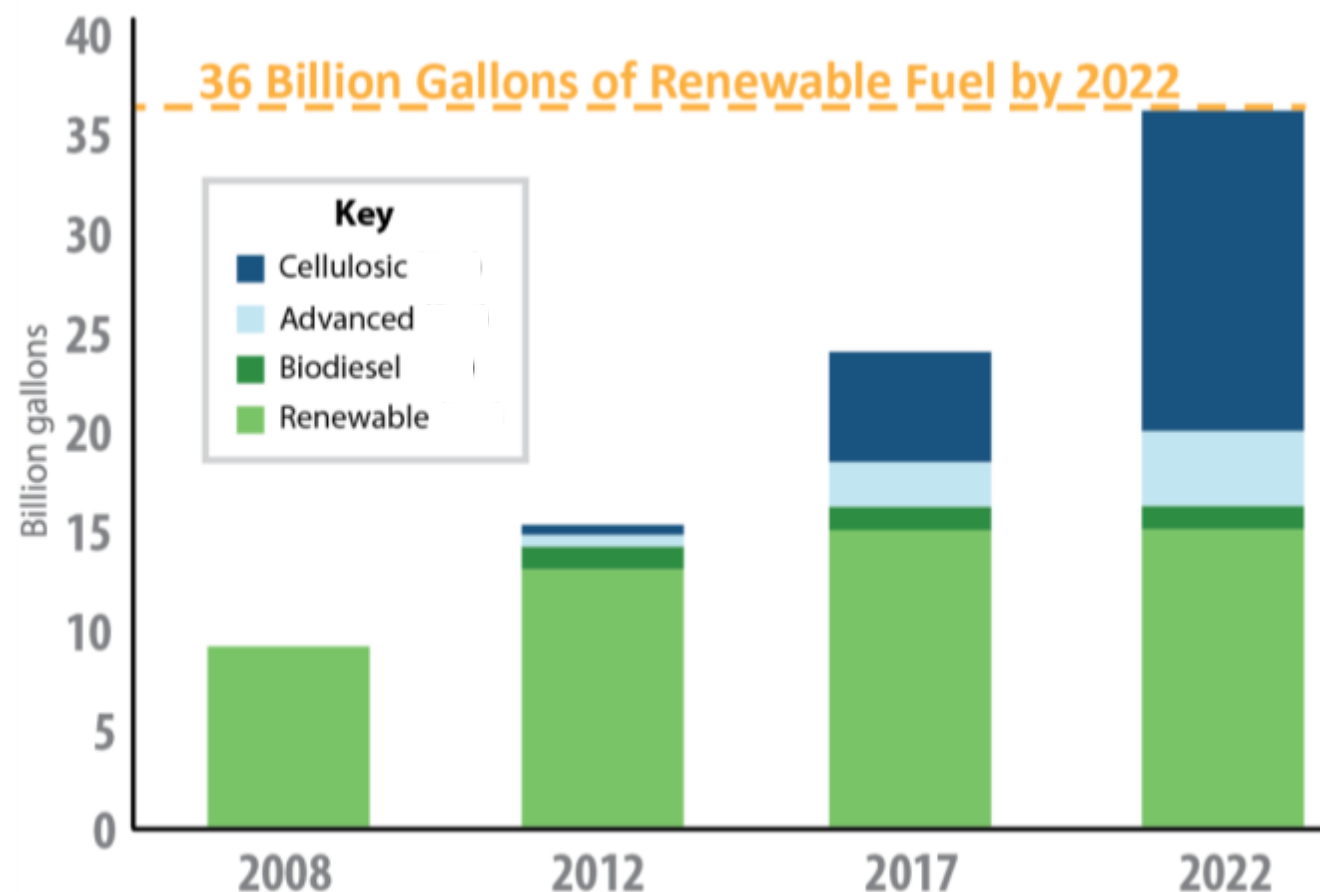


Federal Policies for GHG Emission Reduction in Road-Transportation Sector

Renewable Fuel Standard

- Established in the 2007 Energy Independence and Security Act
- Target 36 billion gallons of renewable fuel production by 2022
- Volume targets adjusted annually by the Environmental Protection Agency
- Fuels must reach a set GHG reduction threshold to qualify as renewable

Volume Targets for Renewable Fuel



State Level Policies and Programs

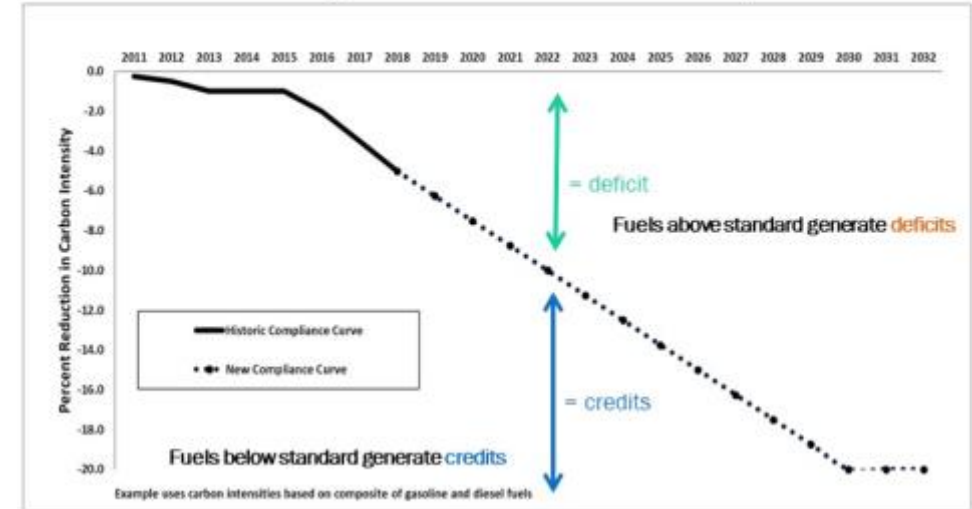
California's Low-Carbon Fuel Standard (LCFS)

- Goal of reducing carbon intensity of transportation fuel pool 20% between 2011 and 2030
- Market for carbon credit transactions exceeding \$2 billion in 2018

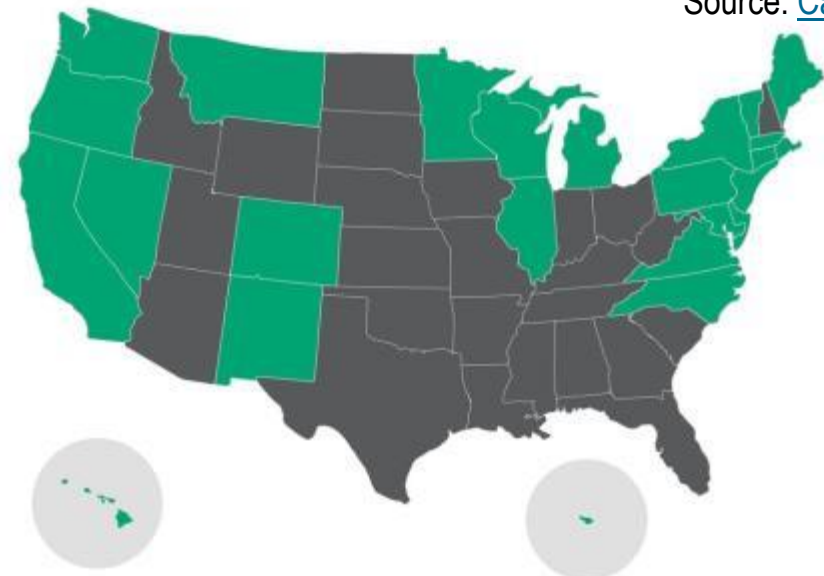
U.S. Climate Alliance

- 24 States and Puerto Rico joined to advance goals of the Paris Agreement
- Reduce GHG Emissions 26-28% below 2005 levels by 2025

Declining Carbon Intensity Curve



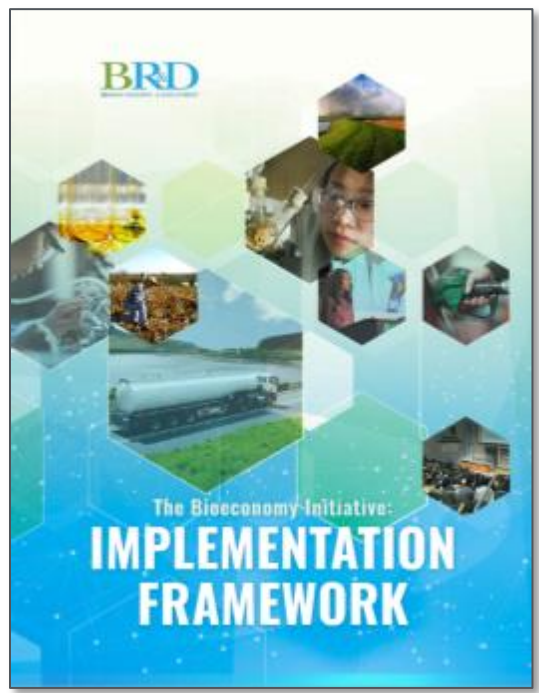
Source: [California ARB](#)



Source: [UN Foundation](#)

The Bioeconomy Initiative

The **Bioeconomy Initiative** is a coordinated federal effort to expand the sustainable use of the nation's abundant biomass resources for biofuels, bioproducts, and biopower.

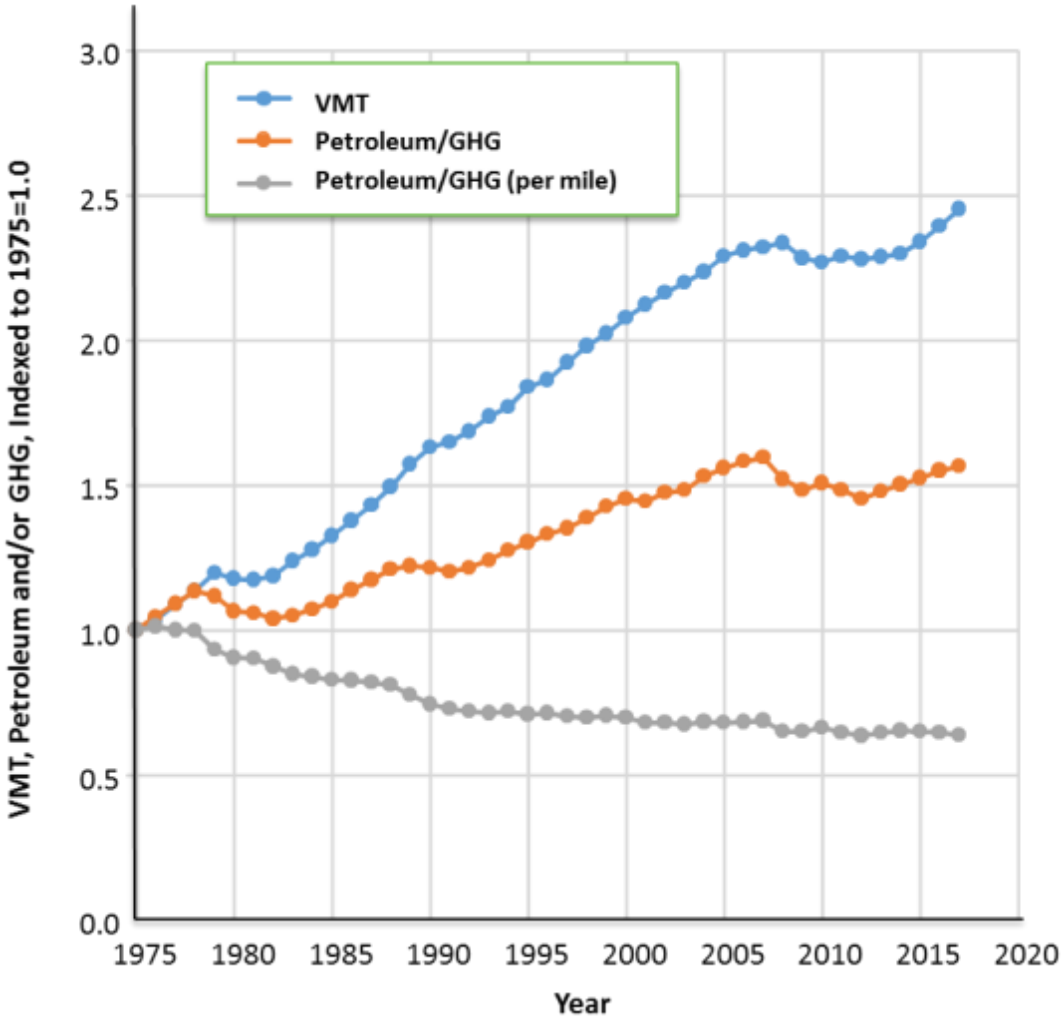


The Framework is now live and available at

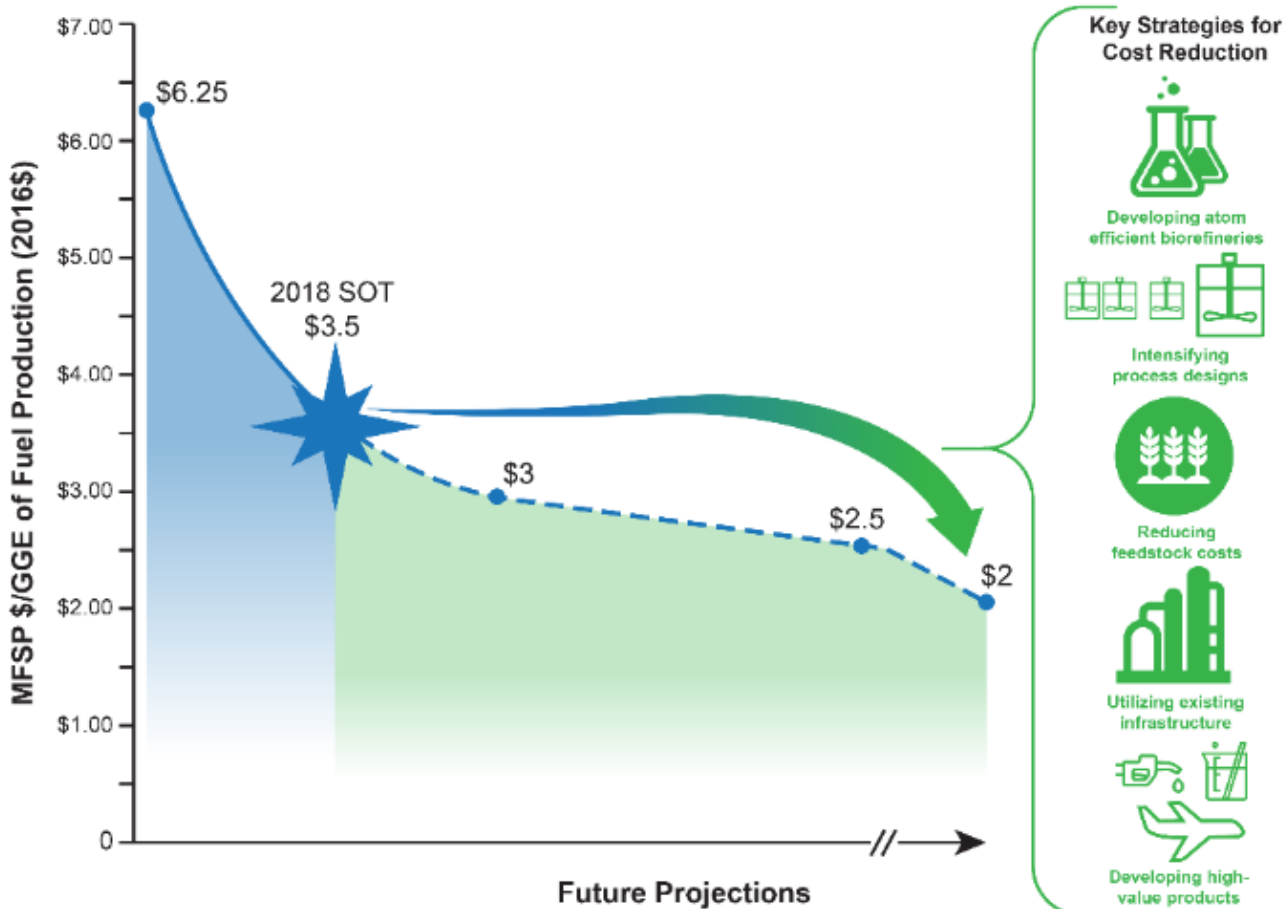
https://biomassboard.gov/pdfs/Bioeconomy_Initiative_Implementation_Framework_FINAL.pdf

Efforts Within U.S. Department of Energy (DOE)

Improve vehicle *energy efficiency and emissions*



Reduce the *cost of biofuels*



Co-Optimization of Fuels and Engines (Co-Optima) Initiative

Co-Optimized
Solution



Engine R&D

Fuel R&D



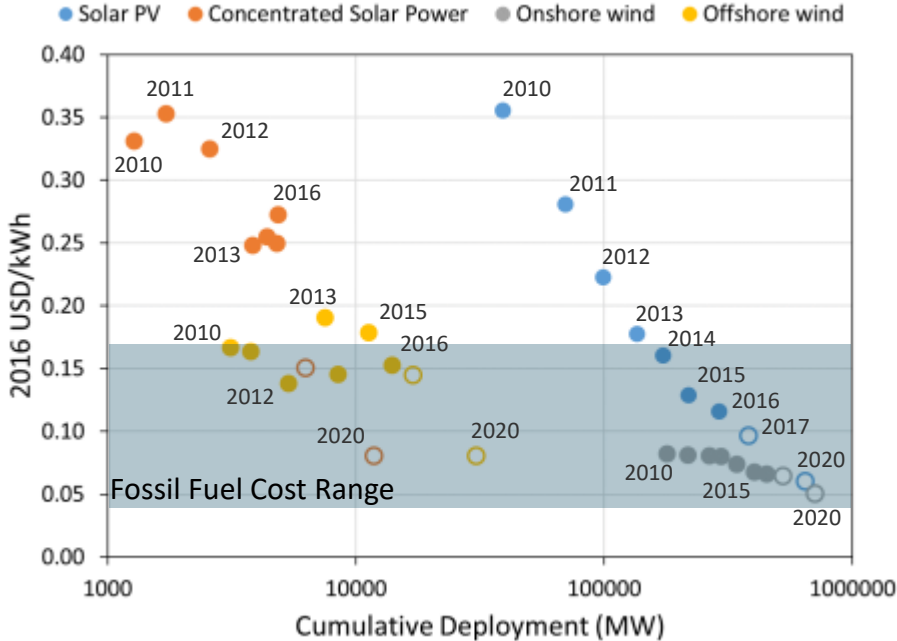
*Co-Optima: better fuels
and better vehicles
sooner*



Objective: Advance the underlying science needed to develop fuel and engine technologies that will work in tandem to achieve significant efficiency and emissions benefits

Exploring Opportunities for CO₂ Utilization

Increasing Deployment and Decreasing Costs of Renewable Electricity



IRENA, Renewable Power Generation Costs in 2017

Future Levelized Costs: \$0.02 - \$0.07/kWh*

- Improve Carbon Utilization while Expanding Markets for H₂
- Offer Lower Carbon Intensity Liquid Fuels to Legacy Vehicles

Growing Need and Opportunity for Utilizing Gaseous Carbon Waste Streams



Government, NGO, Industry, Academia, National Academy of Sciences*

* Josh Schaidle at NREL presentation April 5, 2019

Summary

- Currently no national targets for CO₂ emissions reduction in the USA
- Drivers for transportation decarbonization include:
 - Vehicle efficiency targets (CAFE)
 - Renewable fuel targets (RFS)
 - State level initiatives (LCFS)
- Advanced and cellulosic biofuels production have lagged behind original RFS targets
- R&D efforts at the US Department of Energy focused on:
 - Improving efficiency and emissions (vehicle and system)
 - Reducing cost of biofuels
 - Using lower C intensity fuels and feedstocks
 - Looking at CO₂ as a feedstock resource
- Need to go beyond current efforts if goal is to truly decarbonize

Thank you!



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More information: <https://iea-amf.org/content/news/TD-WS>

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