The Outlook for the Petroleum Marketing Industry

Prepared for Chevron Texaco Petroleum Marketers Association

July 18, 2023

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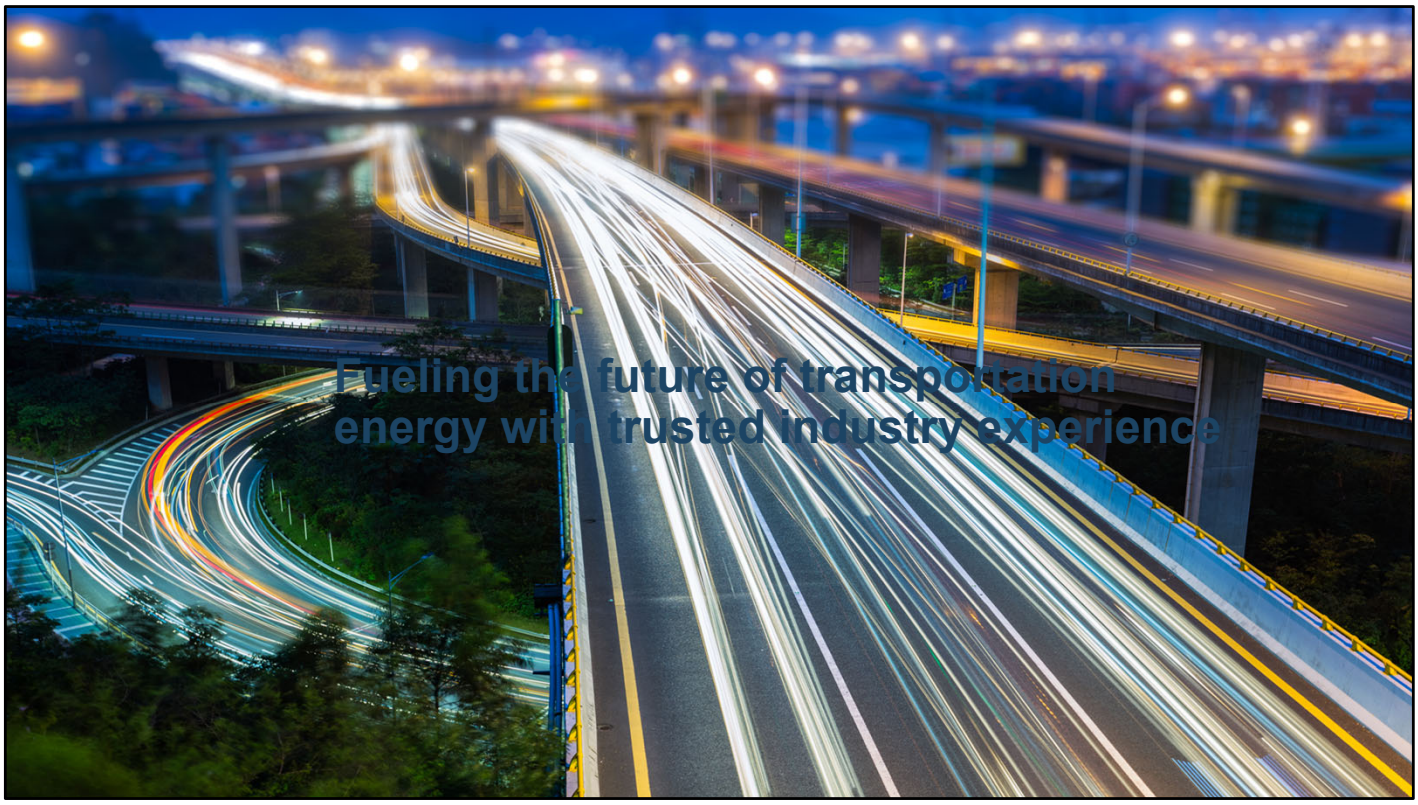


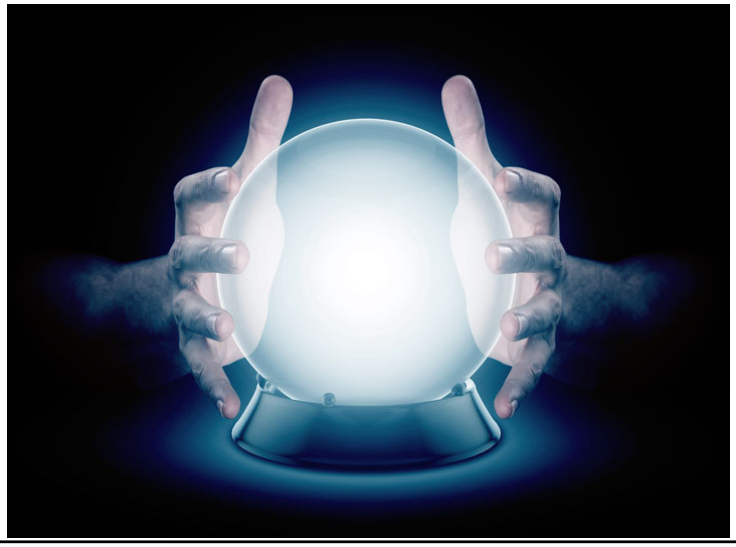
1. Stillwater Associates leverage decades of experience to help clients navigate transportation fuels market challenges. **We see things others miss.**

2. Our clients include government agencies, oil and renewable fuels companies, trade associations, technology developers, private equity firms, and law firms.

3. We are the leading experts on downstream transportation energy markets.

1. Our team of experts is available to provide specific analysis and tailored strategy for your needs.

What's the outlook for the petroleum marketing industry?



There is plenty of uncertainty in the world. Today I'm going to focus on the fuels you sell.

It seems like they are trying to outlaw the fuels you sell

Los Angeles Times

Editorial: EPA wants to speed up EV switch. Good, the planet needs it

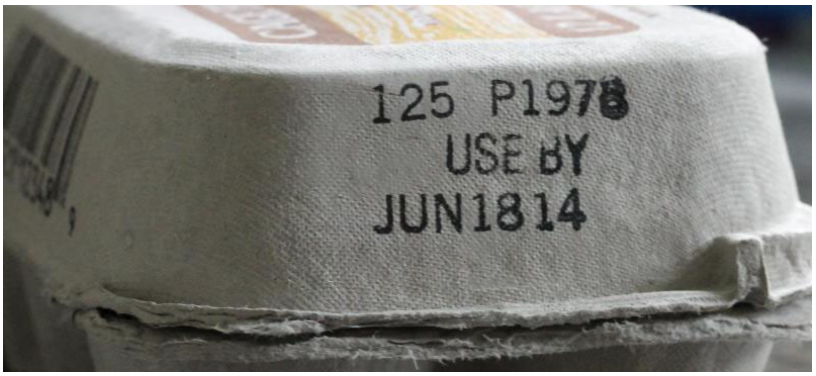
California has banned the sale of new ICE vehicles by 2025. The federal government has set a goal for new car sales in 2030 at 50% Zero Emissions Vehicles The media pounds away at climate change and blames it all on fossil fuels, especially the products you sell.

Editorial link: www.latimes.com/opinion/story/2023-04-12/editorial-the-epa-proposes-a-speedy-switch-to-electric-vehicles-the-planet-needs-it

You are looking for a path forward through all the noise

How is this going to turn out?

Marketers are concerned that fossil fuels are done



Your business is built around the consumer need for fuels.

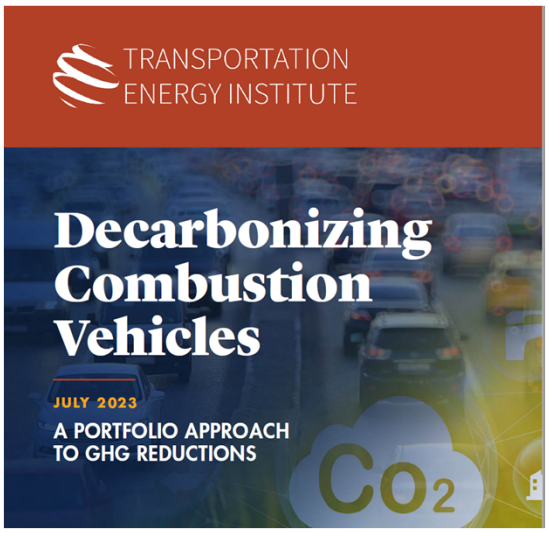
But you need to protect and grow your business and improve the environment

Are there ways to reduce greenhouse gas emissions without rapidly changing your business?

Marketers need to understand that your products can provide a real-world path to cleaner fuels

With a portfolio approach to GHG reduction, progress can be made quickly without having to wait for EVs to dominate the marketplace.

Reducing emissions today is more important than waiting for a new solution down the road



The issue is timing. GHG produced today will be in the atmosphere for a very long time.

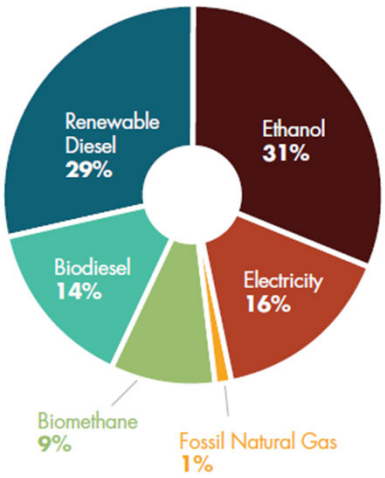
Waiting for the market to transition to Zero Emissions Vehicles, ZEVs without seeking solutions for the dominant powertrain on the roads is a strategy which ignores the substantial reductions which can be achieved in current and future Internal Combustion Engine Vehicles, ICEVs. Embracing strategies to reduce carbon emissions from the nearly 300 million ICEVs that will continue to operate in the U.S. for the next several decades is imperative

Changes can be made to get to get additional GHG emissions reductions from liquid fuels. The Transportation Energy Institute, formerly the Fuels Institute, recently published a paper on the subject written by my Stillwater colleagues.

This afternoon, we are going to look at forecasts from the Energy Information Administration on how they see the market changing. Their forecasts are not as bullish about EV adoption rates as some would like. In the real world, widespread EV adoption will not happen overnight For folks who are concerned about GHG reduction, finding a way to further reduce GHGs using existing infrastructure is a necessary bridge to an all-electric future.

Significant reductions in GHG emissions have been made with biofuels in existing cars & trucks.

FIGURE 18. MOBILE SOURCE CUMULATIVE GHG REDUCTIONS TO DATE

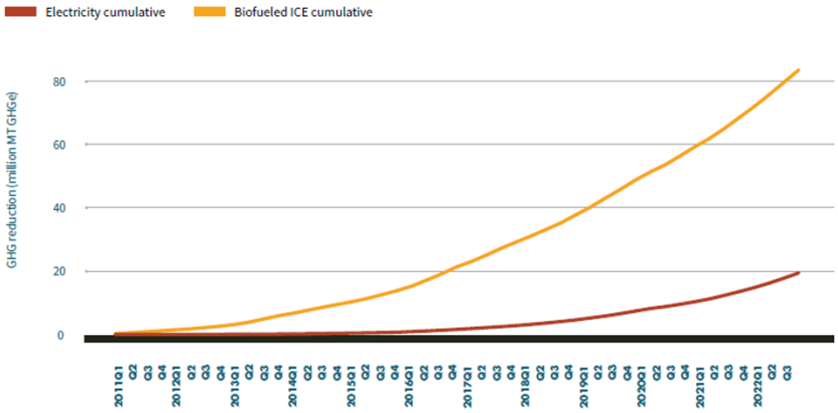


Source: Low Carbon Fuel Standard Reporting Tool Quarterly Summaries | California Air Resources Board

"One real-world example of biofueled ICEVs' potency to reduce GHG emissions is available through California's Low Carbon Fuel Standard. This program quantifies the GHG reduction from alternative fueled vehicles including ZEVs and from biofuels used to meet the state's transportation fuel GHG-reduction goals. 83% of the program's cumulative GHG reductions to-date have come from biofuels and 16% from ZEVs"

In the absence of a large EV fleet, biofueled ICEVs are reducing GHG emissions now

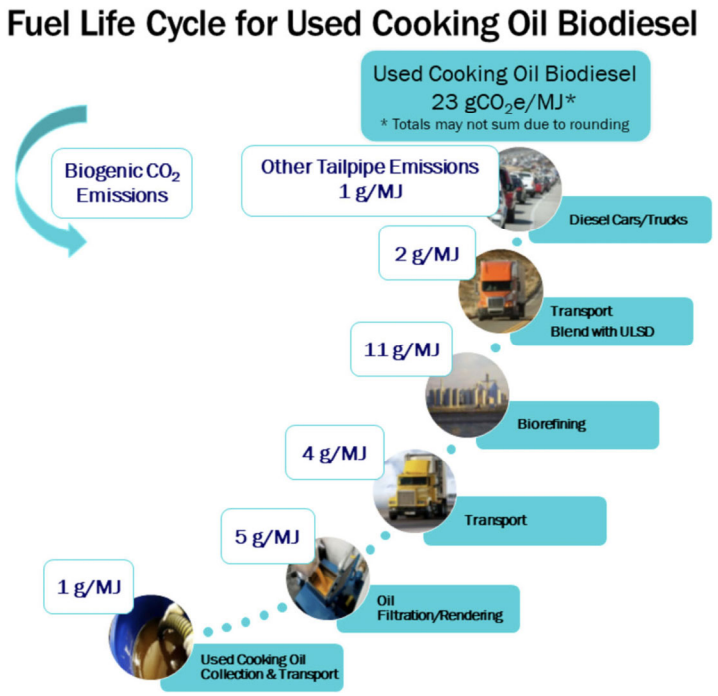
FIGURE 19. CUMULATIVE GHG REDUCTIONS FROM BIOFUELED ICEVs VS. EVs



Source: Low Carbon Fuel Standard Reporting Tool Quarterly Summaries | California Air Resources Board

This chart shows that, cumulatively through 3Q2022, biofueled ICEVs have contributed four times more GHG emissions reductions than EV technologies under California's LCFS.

Carbon Intensity is the amount of energy used to create a fuel



Let's take a moment to talk about Carbon Intensity. Basically, CI is the measure of the how clean our energy is. It refers to how many grams of carbon dioxide (CO2) are released to produce, transport, and use a unit of energy. Low-CI fuels have lower emissions throughout their lifecycle than fossil fuels.

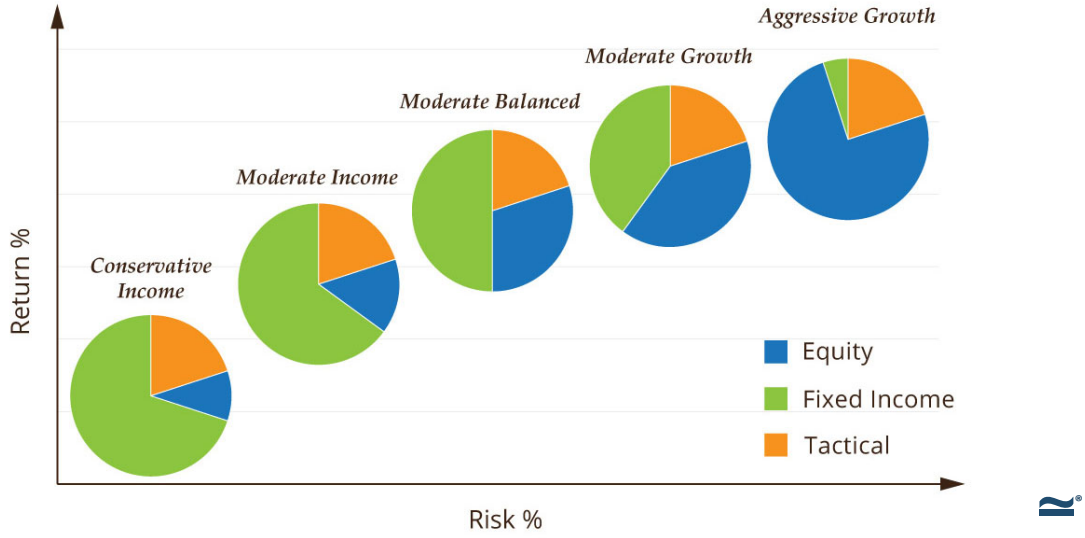
The unit of measure is grams of CO2 equivalent per megajoule of energy. Petroleum diesel CI is about 98 grams/megajoule.

If we want to move to net zero, quick ICEV carbon reductions are crucial

Many near-term options for reducing the carbon intensity of ICEV fuels will enable prompt reductions in carbon emissions since those fuels will be used in the current fleet of ICEVs which will continue to operate for many years to come. Improvements to their fuel economy will amplify these carbon reductions.

Since full ZEV deployment is not without significant challenges, and is not viable as a short-term solution, deployment of lower carbon ICE vehicle and fuel options provides real immediate carbon emissions reductions and can be a hedge against slower ZEV deployment.

Like your investments, we need to take a portfolio approach to GHG reduction



Let's think of the Y axis as CI reduction, instead of Return. So this chart looks at CI Reduction vs Risk.

Petroleum-derived fuels will comprise a substantial share of transportation fuel demand for the next few decades.

Accordingly, opportunities to reduce the GHG emissions associated with these fuels will be key in reducing the overall GHG footprint associated with transportation.

A strategy of completely transitioning from oil & gas quickly – and before the ZEV fleet and infrastructure are sufficiently in place – seems imprudent.

Expanded usage of ethanol, Renewable Diesel, and Biodiesel is the lowest-hanging fruit available to reduce the existing fleet's GHG emissions.

1. Expanding the production of RD, BD, and E85 and their retail availability has significant GHG reduction potential because of the large population of vehicles on the road which can use these fuels.

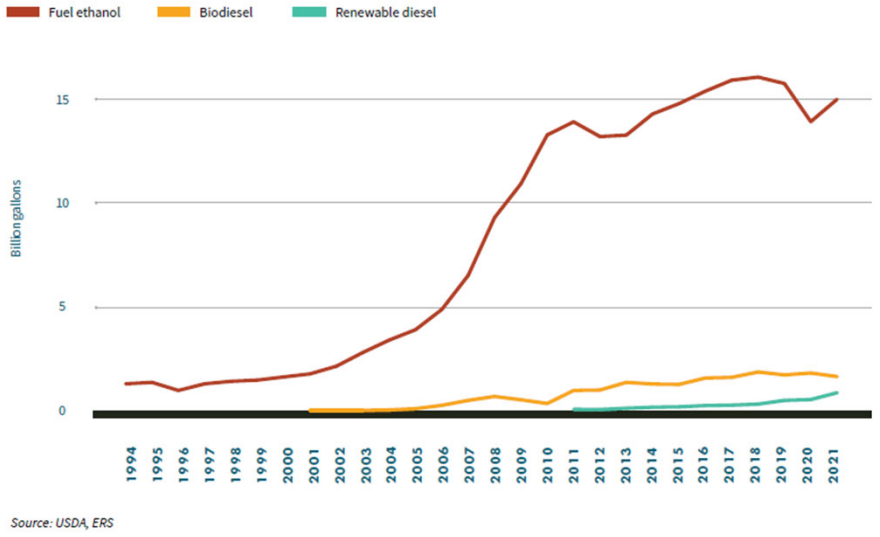
2. FFVs are already on the road, and expanded availability and usage of E85 fuel that is competitive with gasoline prices could reduce GHG emissions by a cumulative total of nearly 13,000 MT from 2025 to 2035.

3. RD and BD growth is ramping up, but their use is limited to diesel vehicles and constrained feedstock supply.

4. Unlike E85, RD is a unique fully drop-in petroleum diesel replacement. RD does not suffer a fuel economy loss compared to petroleum diesel – a significant consumer competitive advantage.

5. BD is a limited blend volume fuel that is compatible with RD and petroleum diesel and has a limited (but significant) role to play in expanding biofuel options. Low-BD blends have energy content like petroleum diesels, but B20 blends have 1.4% lower energy per gallon, equivalent to a five-cent per gallon discount.

Biofuel production in the U.S.

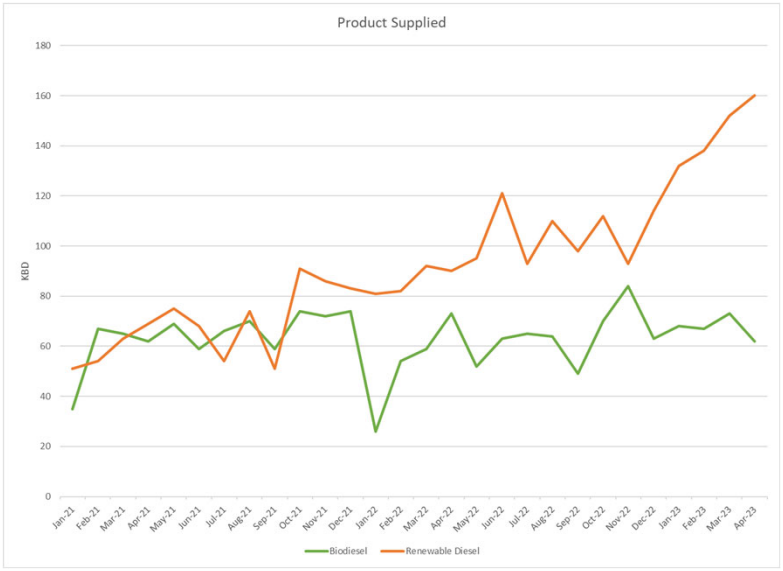


Source: USDA, ERS

Ethanol production in the U.S. had grown from less than 2 billion gallons in the year 2000 to 6.5 billion gallons in 2007 at the time of the passage of the RFS. Since then, it increased to over 16 billion gallons in 2018, when it accounted for 52% of world output. Following the decline in gasoline consumption due to the pandemic and slow growth in its consumption since then, ethanol production has declined and was about 15 billion gallons in 2021. The U.S. is both an importer of sugarcane ethanol from Brazil and a growing exporter of corn ethanol to the rest of the world. Ethanol imports have been small and declining in recent years while ethanol exports have grown to about 1.2 to 1.8 billion gallons a year in recent years.

As well, BD production has grown from negligible levels in 2002 and doubled between 2011 and 2016, reaching about 1.5 billion gallons in 2016, accounting for 20% of world output. Over time, the amount of RD produced has also grown and is now equal to that of BD in the U.S.; together they reached a peak of about 2.4 billion gallons in 2020. Growing rapidly, RD product supplied outstripped BD in 2022.

Looking at recent RD & BD data:



Renewable Diesel

Biodiesel

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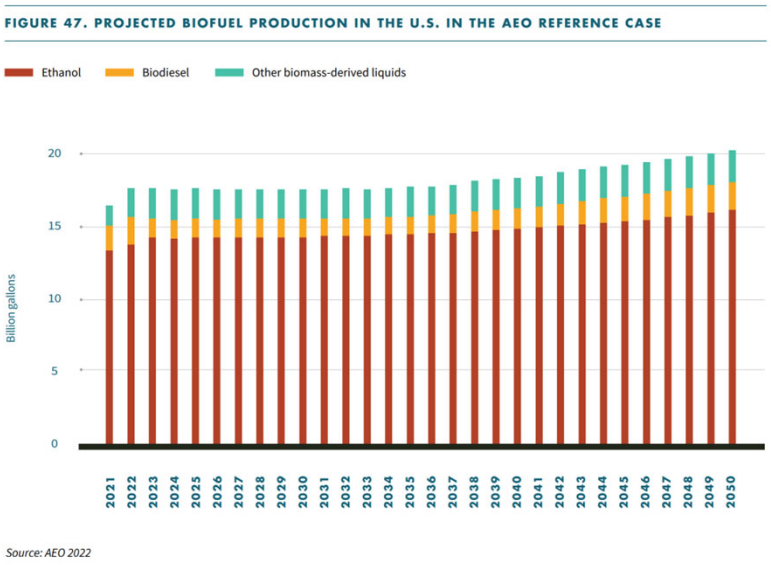
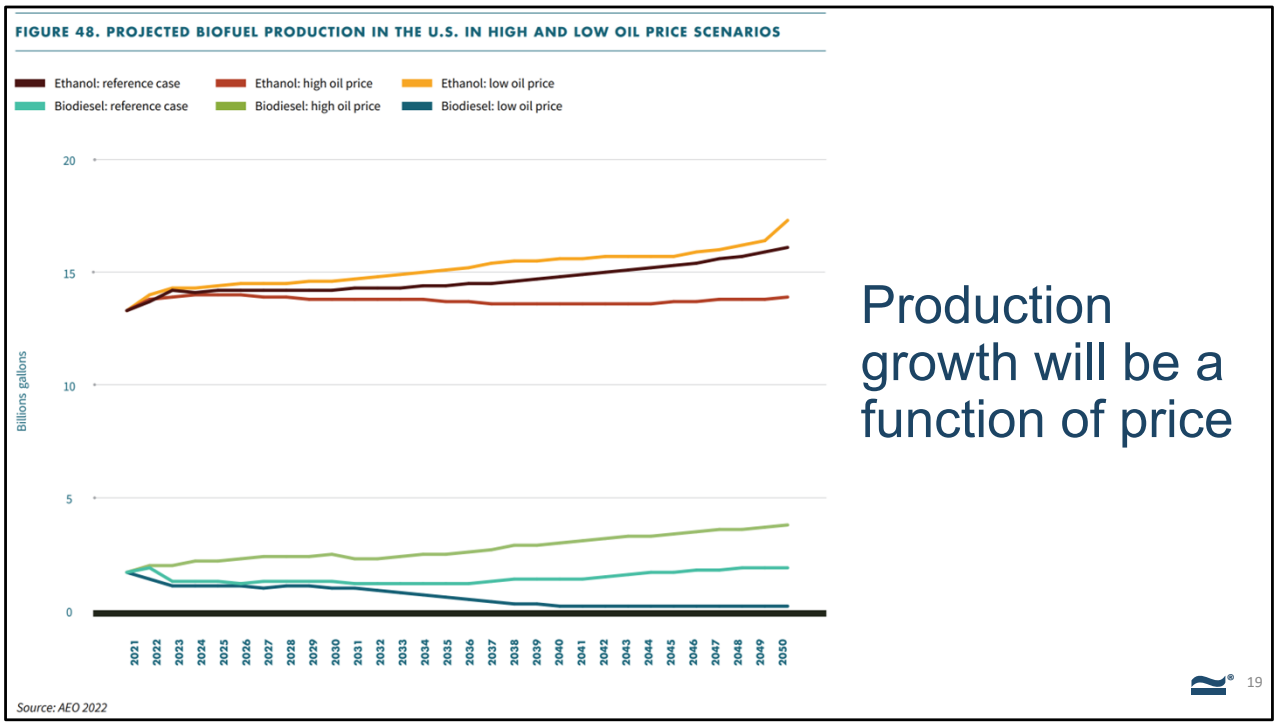
EIA's product supplied included imports. RD product supplied has increased as additional capacity has some online. More plants are being built. Stillwater expects that RD will take market share from BD because of superior economics.

Farmers are good at figuring out how to meet increased demand



Improved yields per acre, high oil seeds, better farming technology has led to increased supply without a dramatic increase in acreage.



EIA Annual Energy Outlook has a Reference Case, then several scenarios. In this example the scenarios were high and low-price assumptions.

Higher prices will do what the always do, eventually increase supply.

To significantly increase the volume of biofuel, the industry will rely on non-food crops

Significant shares of the byproducts of current food crops—corn and soybeans—are already being converted to biofuel. Fats, oils, and waste greases are also being converted to BBD, but their quantities are limited and dependent on supply conditions in other markets. Nonfood crop options for biofuels offer the potential for increasing dedicated supply of feedstock without displacing food crops and minimizing diversion of cropland to fuel production. These feedstocks include cover crops like pennycress and carinata, which can be converted to BBD, as well as biomass from residues of corn, wheat, and dedicated energy crops. High-yielding energy crops which are typically perennials, like miscanthus, switchgrass, and energy cane, as well as short rotation woody crops, like poplar and willow, and some annual crops, notably energy sorghum, are being considered for biofuel production

Here are TEI's18 alternatives for a lower GHG emissions portfolio

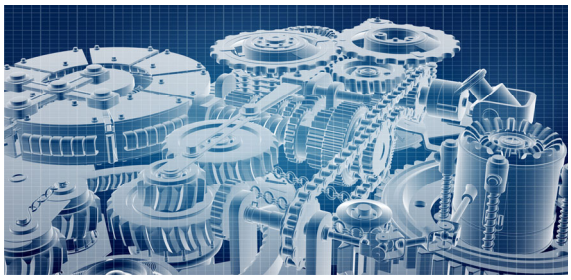
TIER	OPTION	PAIRED VEHICLE TECHNOLOGY	CARBON REDUCTION VS. CURRENT FLEET & FUELS	POTENTIAL IMPACT	INITIATIVES REQUIRED	
					REGULATORY	MARKETPLACE
0	Current ULSD & E10 Gasoline	Current Gas ICEV	base	N/A	N/A	N/A
1	Biodiesel (B5)	Current Diesel ICEV	<5%	small	N/A	Increased feedstock generation
1	Ethanol (E15)	Current Gas ICEV	3%	small	Wider EPA approval	Infrastructure build-out
1	Renewable Gasoline (RG)	Current Gas ICEV	50-70%	small	Continuation/expansion of existing regulatory incentives	Scalability of production
1	Renewable Natural Gas (RNG)	NGV	100+%	small	Continuation/expansion of existing regulatory incentives	Conversion of vehicles and fueling infrastructure
1	Renewable Propane (RP)	LPG ICEV	60-70%	small	Continuation/expansion of existing regulatory incentives	Conversion of vehicles and fueling infrastructure
1	Reduced CI Gasoline & Diesel	Current ICEVs	5-15%	small to medium	Strengthened regulations on upstream flaring and methane emissions; continued move to renewable marine fuels; continued regulatory incentives for CCUS and use of renewable energy at refineries	Refinery investment in CCUS and usage of renewable energy
1	Ethanol (E15)	Hybrids (HEV & PHEV)	20%	small to medium	E15 approval and increased incentives for hybrid expanded vehicle purchases	Conversion to hybrid vehicle fleet and expansion of E15 infrastructure
1	Biodiesel (B20)	Current Diesel ICEV	5-15%	small to medium	N/A	Increased feedstock generation
1	Ethanol (E85)	FFV	15-25%	small to medium	Increased incentives for FFV production and purchase (adjustments to CAFE) and potential aftermarket equipment certification program for FFV conversions	Fueling infrastructure expansion and increased vehicle and fuel availability

TIER	OPTION	PAIRED VEHICLE TECHNOLOGY	CARBON REDUCTION VS. CURRENT FLEET & FUELS	POTENTIAL IMPACT	INITIATIVES REQUIRED	
					REGULATORY	MARKETPLACE
1	Renewable Diesel (R99)	Hybrids (HEV & PHEV)	55-85%	medium	Increased incentives for hybrid vehicles	Conversion to hybrid vehicle fleet and increased feedstock generation
2	Ethanol (Intermediate Blends)	Dedicated Vehicle	5-15%	small	New incentives for development of dedicated intermediate-ethanol-blend vehicle production	Expanded compatible fuel infrastructure
2	Biodiesel (B20+)	Current Diesel ICEV	40-60%	small	Establish ASTM standards	OEM warranty, expanded fueling infrastructure, and increased feedstock generation
2	ICEV Improvements	NA (current fuels)	20-50%	medium	Technology-neutral testing and CAFE standards	Broad OEM roll-out
2/3	Hydrogen (H_2)	H_2 ICEV	60-100%+	small	Substantial financial incentives	Build-out of hydrogen production hubs, expansion of dedicated fueling infrastructure, conversion of vehicle fleet to H_2
3	Cellulosic Ethanol (E10)	Current Gas ICEVs	5-10%	small	Substantial financial incentives for fuel and technology development	Technological breakthrough to reduce production cost
3	Cellulosic Diesel	Current Diesel ICEVs	60-90%	medium	Substantial financial incentives for fuel and technology development	Technological breakthrough to reduce production cost
3	FT Diesel (BTL)	Current Diesel ICEVs	20-100+%	medium	Substantial financial incentives for fuel and technology development	Technological breakthrough to reduce production cost
3	Pyrolysis Fuels	Current Gas & Diesel ICEVs	0-60%	large	Substantial financial incentives for fuel and technology development	Technological breakthrough to reduce production cost
3	E-Fuels	Current Gas & Diesel ICEVs	40-100%	large	Substantial financial incentives for fuel and technology development	Technological breakthrough to reduce production cost

Many of these require a continuation or expansion of existing regulatory incentives for renewable fuels.

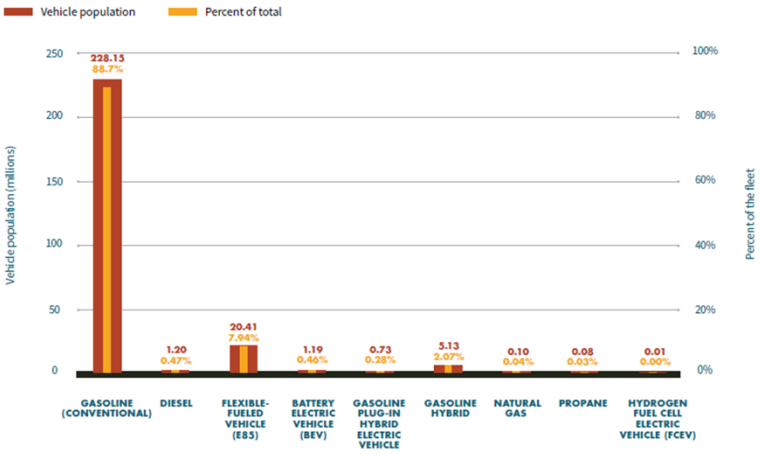
Included in this list is Renewable Gasoline, a product that Chevron is a leader in testing.

ICE cars and trucks aren't going away anytime soon



I am about to show you that Internal Combustion Engine Vehicles will be around for a long time.

The light-duty vehicle population is dominated by gasoline vehicles



Source: EIA AEO 2022 Vehicle Stock Table 39

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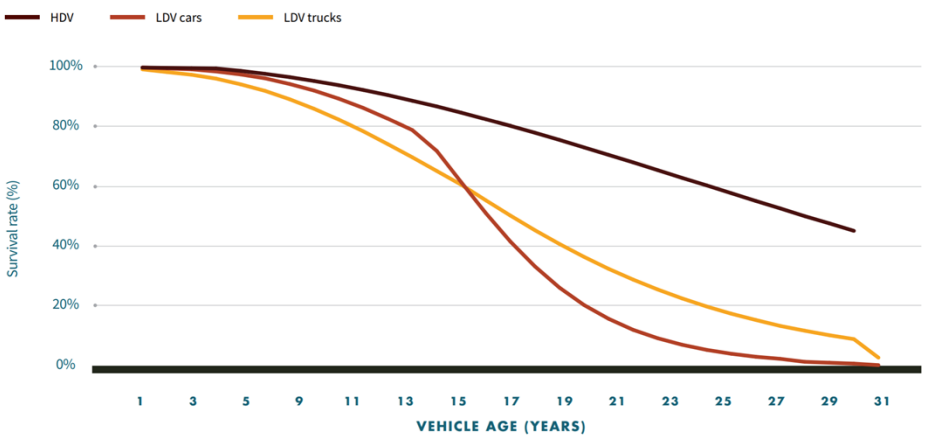
There is a huge installed base of gasoline burning light cars and trucks.

Cars and trucks last a long time these days

FIGURE 5. VEHICLE SURVIVAL RATE FOR CARS, TRUCKS, AND HEAVY-DUTY TRUCKS



Source: Oak Ridge National Laboratory Transportation Energy Data Book Edition 40, *Tables 3.14, 3.15, 3.16.*

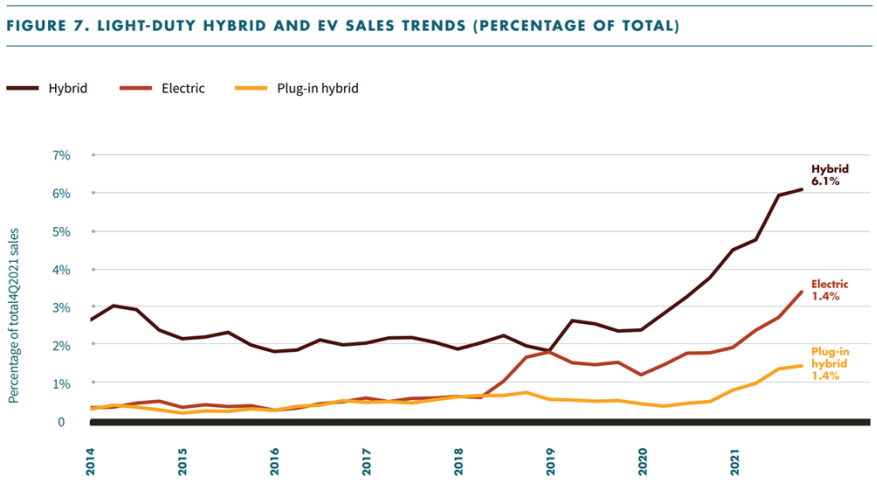
Based on recent data from the Oak Ridge National Laboratory, vehicle survivability varies by several factors, including vehicle class. As can be seen, across all vehicle classes, 20% of current vehicles will still be on the road in 20 years or more:

1. 20% of cars are on the road after 20 years
2. 20% of light duty trucks are on the road after 24 years
3. 20% of heavy duty vehicles are on the road after 34 years

After 29 years, new vehicle sales are estimated to replace 98% of the ’21 vehicle population

98% turnover in 29 years.

EV adoption rates are increasing, but EVs are not expected to dominate the fleet in the near term

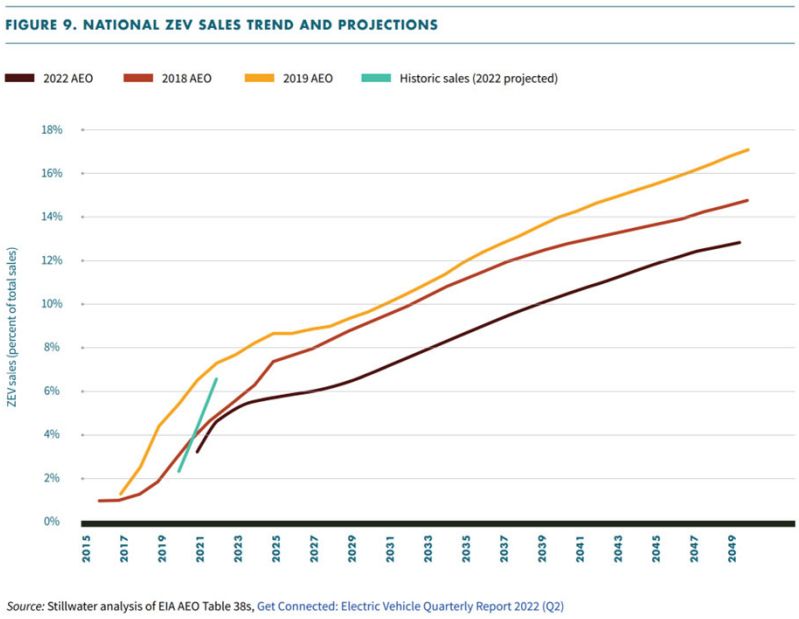


EV sales picked up especially when gas prices got high with the start of the Ukraine war in 2022

Today the WSJ reported that Ford was slashing prices for their electric F150 by $10k. Manufacturers are making EVs faster than they can sell them as inventories have reached 92 days of supply. ICEV inventories are reported at 54 days of supply.

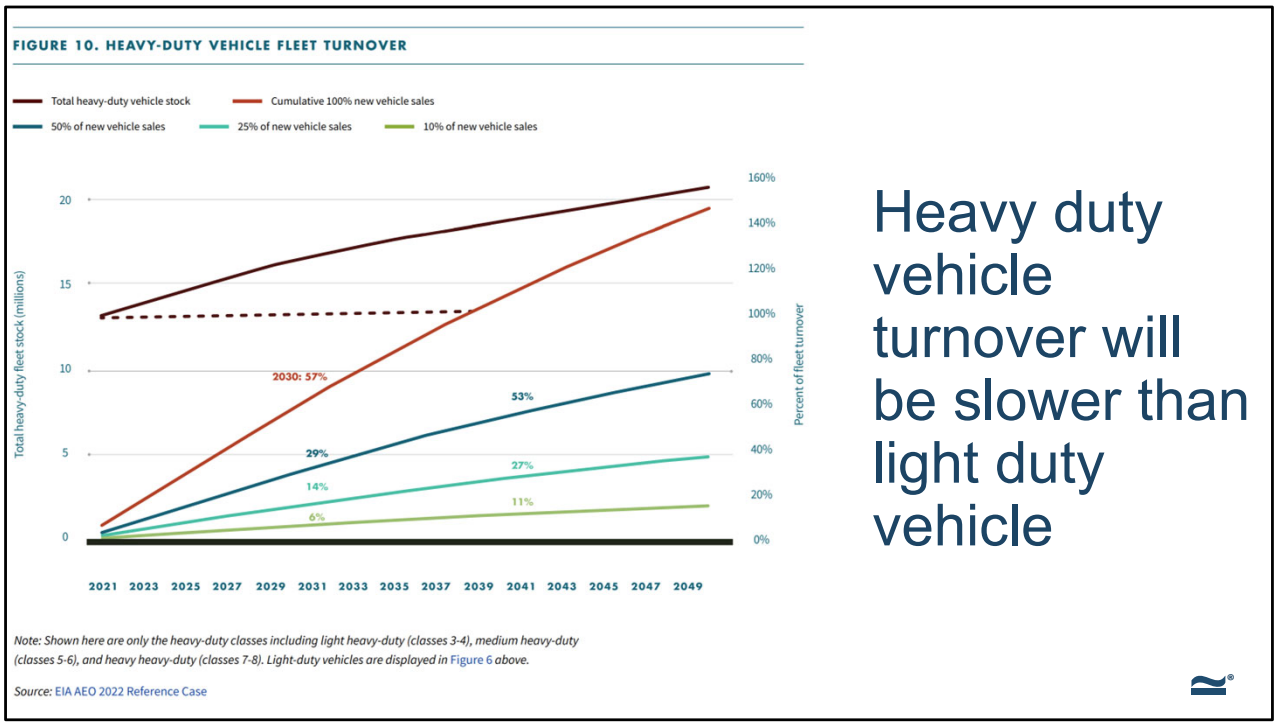
Auto manufacturers will have a very difficult time making and selling half of their fleet as EV's by 2030.

National ZEV sales trend & projections



Source: Stillwater analysis of EIA AEO Table 38s, Get Connected: Electric Vehicle Quarterly Report 2022 (Q2)

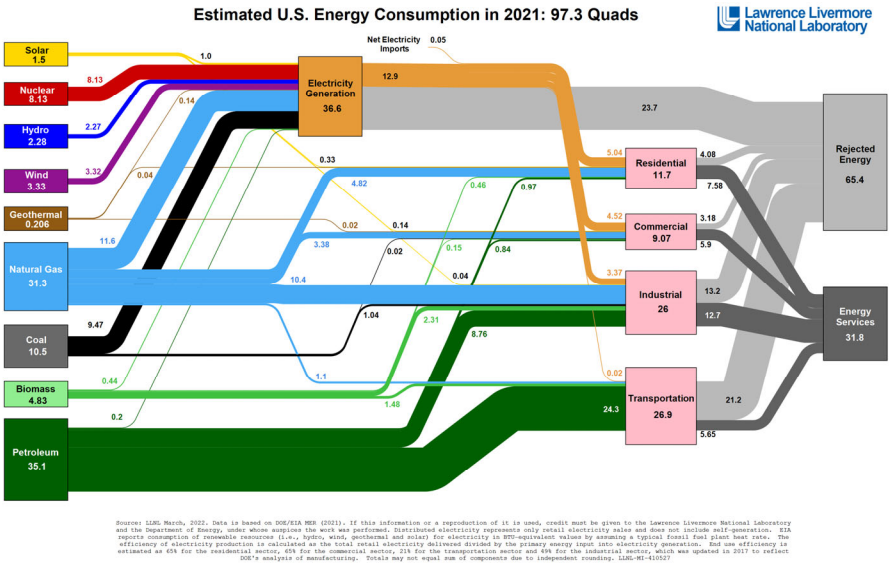
Its hard to see that ZEV sales will be as much as 15% of the fleet by 2030.



Heavy duty vehicle turnover will be slower than light duty vehicle

Per the 2022 AEO Reference Case, the turnover rate for light heavy-duty, medium heavy-duty, and heavy heavy-duty vehicles is currently 19 years based on total projected new heavy-duty vehicle sales and 2021 vehicle population. This figure shows this 19-year turnover rate, indicating that new vehicle sales will replace the entire 2021 vehicle population in 2039. Also shown is the vehicle turnover rate assuming that a new technology represents 100%, 50%, 25%, and 10% of new vehicle sales. EV migration will most likely happen in the light heavy-duty vehicles (classes 3-4) and medium heavy-duty vehicles (classes 5-6). EVs are currently mandated for California heavy heavy-duty transit buses, and some other states are in trials with heavy-duty transit EV buses. Presently, however, medium- and heavy-duty (M&HD) EVs cost four times more than their diesel counterparts.18 Hence, M&HD projections are contingent on governmental mandates and subsidies.

Today, most of the energy consumption in the U.S comes from fossil fuels



I have always wondered how to think about the overall supply and demand for energy. This Livermore National Lab diagram helps. On the left are the supply categories and on the right are the consumption categories. The lines connect the supply with the consumption.

Of the 97.3 quadrillion BTUs of energy supplied in 2021, fossil fuel supplied 76.9 quads or 79%. Most petroleum went to transportation or Industrial uses. Coal mostly went to Electricity Generation. Natural gas was spread around Electricity Generation, Residential (heating & cooking), Commercial and Industrial.

Note that Rejected Energy is 2/3s of the total. Included in this category are wasted heat from combustion, friction, and from transmission losses. Recovery of this energy is an important way to reduce carbon intensity.

Moving transportation energy from the pipeline to the wire will be difficult

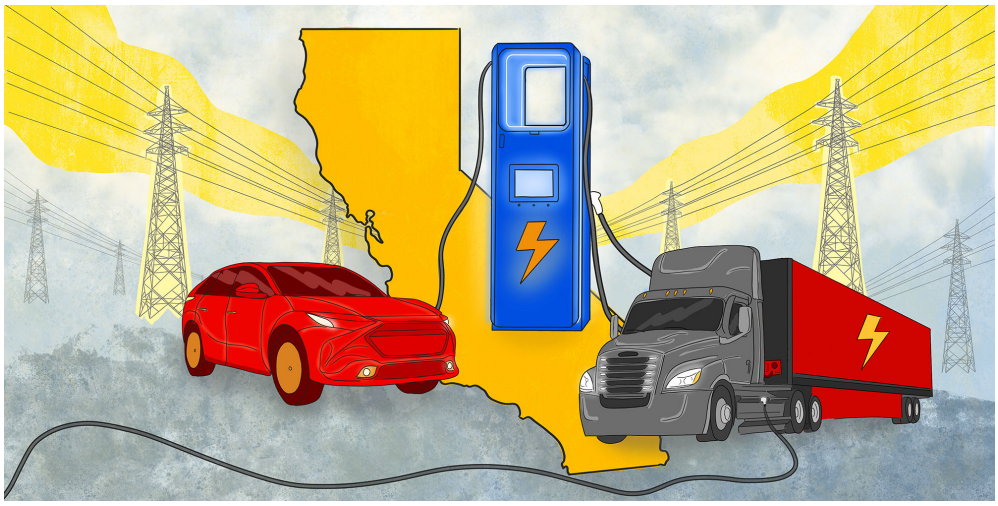
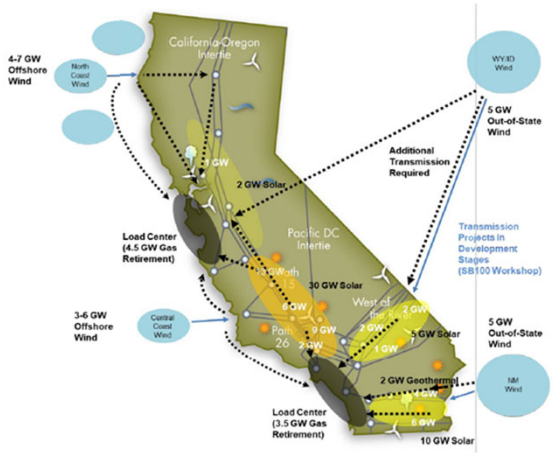


Illustration by Julie A. Hotz for CalMatters

At Stillwater we are calling this “the energy transition”. Petroleum makes up about 36% of the total energy supply in the United States. The time and money required to generate, transmit, and distribute that much new electrical energy will be enormous.

The transition will be expensive

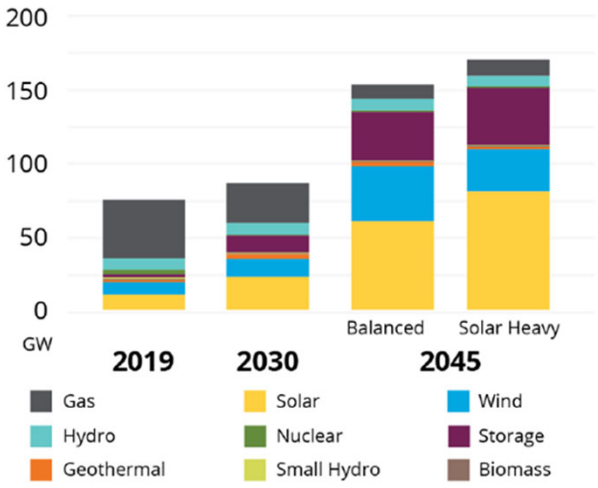


Source: "20 Year Transmission Outlook" California ISO, May 2022

This graphic from the California Independent System Operator (CAISO) illustrates the magnitude of the changes required to get to net zero. In short, lots of wind & solar generation and transmission lines must be built in record time to meet the 2045 deadline.

CAISO reckoned the cost of transmission development to match their diagram alone would be about $30.5 billion.[1]

Power generation will have to grow strongly



SCE forecasts capacity growth by type

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Large increases in solar and wind generation are assumed. Because the sun doesn't always shine and the wind doesn't always blow, power storage must be built on a scale never before engineered.

SCE's Pathway 2045 report says: "By 2045, more than 80GW of additional utility-scale energy storage will be needed in CAISO's footprint. This is an annual development rate two to three times higher than historical levels and represents approximately $170 billion of clean energy investment." That report also indicates: "From 2030 to 2045, grid investment of up to $75 billion will be required to integrated bulk renewable energy generation and storage and serve the load growth associated with transportation and building electrification."

There will be resistance

Consumers, ratepayers and taxpayers will balk at the cost.

Customers want to be part of the solution

They want to fight global warming, but they have other priorities too.

The Bottom Line

1. There are real world steps that can be taken to reduce carbon intensity without replacing today's fleet of vehicles.

2. Taking these steps will lower the risk if the energy transition does not go as envisioned

3. Stakeholders will have to ensure that their representatives, suppliers, customers and trade associations understand this message.

A transportation energy consulting firm focused on policy, technology development, mergers & acquisitions, and litigation support.

888-643-0197
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What else shall we talk about?

- Renewable Diesel
- Sustainable Aviation Fuel
- Renewable Gasoline
- Energy transition
- California's SB2
- National LCFS
- Credit prices